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Visual Communication Design — Master of Design Thesis Project

Development of computer-based aids for teaching music to grade 2 students:

an animated listening map to aid in the teaching and learning of musical concepts, primarily through listening and responding activities

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Abstract

This thesis project is concerned with the development of a computer-based aid to support the understanding, recognition, appreciation, and enjoyment of music at the grade 2 level of elementary education. Specifically, it consists of an *animated listening map,* a type of instructional material proposed to support the teaching and learning of specific musical concepts to grade 2 students, primarily through listening and responding activities.

An *animated listening map* is a spatial arrangement of images on the computer screen that changes over time to respond, in a particular way, to the musical pattern in a piece of music being played on the computer.

The design process carried out for the creation of the animated listening map consists of 4 phases: design problem; design strategy; design proposal; and design evaluation. The definition of the design problem is based on a literature review conducted in the areas of computer-aided instruction, children's cognitive development, elementary music education, and principles of visual communication. The design strategy phase presents the definition of the general and specific design objectives based on the instructional objectives, literature-based premises, and the definition of the specific medium and instructional situation. The third phase, design proposal, addresses the description of the configuration of the animated listening map and the visual system used to develop it. The design evaluation phase involves two small assessment studies conducted to explore the effectiveness of using the animated listening map for music instruction.

The design process described in this document highlights specific guidelines for the design of animated listening maps based on evaluation outcomes.

Visual communication design as a discipline can be understood as the awareness of information, principles, and methods gained through study and practice that allows designers to systematically create visual messages, which are aimed at generating particular responses from particular audiences. Frascara (1994) notes that, particularly, the designer is concerned with creating the act by which the public interacts with a visual message to produce the communication. Thus, visual communication design is aimed toward developing communicative situations rather than particular objects of design. (pp. 19-27)

In this communicative situation, there are factors and elements that affect and form part of the process of interacting with the visual message. The bio-psycho-socio-cultural nature of the individual acts as an internal force in the perception of the visual message. An external influence is also created by the context, the particular situation and circumstance in which the communication takes place. In this regard, Frascara compares the design activity with that of a director, stating the following:

> the designer, in this way, coordinates research, conception, and development of visual messages by using information or approaching professionals from other areas concerned with the requirements of the different design projects. (p. 20)

In the area of education, the communicative situation or instructional situation involves the interaction between the teacher, the students, and the visual message or instructional material that allows the process of teaching and learning to occur. To create this instructional situation, the designer contemplates how the teacher and the students will use the instructional material. The teacher is motivated to creatively 'complete' the instructional message by delivering it to the students. The students are motivated to think, to judge, and to develop their cognitive, affective, and behavioral capacity through the understanding of the instructional message. Therefore, the design activity contributes to the development of the individuals by facilitating and enhancing the process of teaching and achieving the anticipated learning outcomes (Frascara, 1994, p. 109).

This thesis draws on knowledge from disciplines such as educational technology, computer sciences, developmental psychology, and elementary music education to conceive, develop and evaluate an alternative to the design of computer-based aids to teach music literacy to children at the elementary school level.

Educational technology provides the principles and knowledge for designing effective instruction to be delivered by technological media such as the computer. Feldman et al. (2001) state that educational technologists

designers are the professionals who, working with the administrators, teachers, parents and students of a school, provide expertise in properly integrating the technology to enhance the instruction in particular curriculum content. Thus, their work generally includes the identification of specific student needs, the definition of instructional goals and strategies, and the design of content that, when delivered with the aid of or by a technology medium facilitates and improves the achievement of specific student outcomes (p. 45).

In order to deliver effective instruction through a computer, visual communication designers must be knowledgeable about computer technology and software to be conscious of their capabilities as educational media. To clarify some terminology, in this thesis, the term *computer-based instructional aid* is used to refer to a software program that displays instructional information on a screen to support the teaching and learning of specific curriculum content in a classroom environment.

Developmental psychology provides the theories defining the cognitive, affective, and behavioral growth of human beings. In this thesis, the cognitive theories of Piaget and Vygotsky, and the Information-Processing approach to cognitive development, that is based on the work of Atkinson and Shriffin (1968), have been studied in order to understand how elementary-level students use new knowledge and experiences. According to Piaget (1969), during the first years at the elementary school, students develop the ability to form and relate mental ideas through applying formal methods or operations for understanding their world. This primary elaboration and connection of ideas or concepts is based on concrete models, real and familiar images presented in real and familiar situations. Piaget defines this stage of development as *concrete operational,* which includes the ages between 7 and 11 years (pp. 92-101). Based on Vygotsky's theory, the development of cognitive abilities is stimulated and modeled by social interaction and the elements received from the children's culture (Shaffer, 1999, pp. 259-268). The Information-Processing approach provides a detailed description of the cognitive activity and the mechanisms prompting development, based on the observation of how information is treated in computers environments (Kail, 1998, p. 168; Shaffer, 1999, p. 271). Finally, the cognitive abilities characterizing the concrete operational stage, that are modeled by socio-cultural factors, as well as the mechanisms affecting development, have been considered in order to determine how to visually 'imitate' the students' way of understanding things for the creation of intelligible aids for music instruction.

Nye et al. (1992) note that music education makes a valuable and essential contribution to general education. In elementary school, through the appreciation, performance, and creation of music, children develop their sensitivity to and discernment of 'beautiful' things in their environment. In addition, children can learn about themselves and others by having emotional experiences. By feeling the 'spirit' giving life to particular musical patterns, children learn about artistic expression from their own and other cultures. The authors contend that, "a growing number of educators have found that music is an excellent vehicle for cognitive development" (p. 3). They note that the musical activities prompt intellectual activities in the minds of children, stimulating cognitive, behavioral, and affective experiences.

> Muscle, voices, ears, and eyes work in combination with the brain. The arts contain prerequisites to cognition such as interpreting symbols, coordinating muscles, stimulating imagination, and refining perception. Music and other subjects unite in the mutual goal of public instruction. (p. 3)

One of the musical activities undertaken, during the first years at primary school, consists of introducing students to the interpretation, understanding, recognition, and enjoyment of contemporary and classical music, by having them associate images with the music to which they are listening to. These images are presented in the form of *listening maps,* that are spatial arrangements of images and iconic symbols that represent, in particular ways, the musical patterns described by musical pieces. Specifically, listening maps are representations of musical concepts, the musical components, giving form to particular pieces of music. In this thesis, the development of a proposed computer-based aid for the effective instruction of music is based on the observation and analysis of some listening maps created for grade 2 level instruction, and the analysis of the music to be taught.

Design problem:
design of effective computer-based aids for music education

The design project in this thesis broadly consists of developing a computer-based instructional aid to introduce students to the understanding, recognition, appreciation and enjoyment of music at the grade 2 level in elementary school. In order to narrow the scope of this definition and to subsequently define the design objectives, a literature review has been carried out in the following areas: the effective use of the computer in elementary school, children's cognitive development, music education for grade 2 students, and principles of visual communication.

1.1 The use of the computer in elementary education

The computer can be used in the classroom as a medium for delivering computer-based instruction or as a tool to enhance the teaching and learning processes of specific subject-area content based on new curriculum standards (Feldman et al; 2001; Slowinsky et al; 2001).

In music education, the computer can be used to integrate the arts with other subject-areas of the curriculum in order to improve the process of learning and make it more enjoyable (Slowinsky et al; 2001). As well, the computer can be used as a tool to aid in the teaching and learning of particular musical skills. An example of this is software that helps teachers/students to teach/achieve aural and visual recognition of the interval, a musical concept that represents the difference in pitch between two musical sounds (Stevens 1987, p. 19).

The following computer-aided instructional projects have been developed based on research carried out in the area of children's cognitive development, a field that was pioneered by the psychologist Jean Piaget during the first half of the twentieth century. These projects have been designed to create familiar, easy to understand, and engaging learning environments that offer children new ways of gaining knowledge (Maier, 1978, p. 23).

Computer-based instruction

Kemp, Morrison, and Ross (1998) define computer-based instruction as the use of "a software program that displays information and instructions on a video screen, requiring learner participation and choices" (p. 291). Kail (1998) refered to it as a type of self-directed instruction through which children individually interact with computers to achieve particular outcomes. In this regard, they learn at their own pace by receiving feedback and help. The teacher participates as a mentor, providing extra support when it is required (p. 405).

OWL – On-line Webstories for Learning

OWL is a Web-based instructional resource created by Education On-Line (EOL) in 1998 to teach literacy concepts and concept development to children. The Web site hosts stories with which children interact as they read by completing activities that are meaningfully connected with the sequence of events. These activities are complemented by others that children perform later, on printed materials, to reinforce the concepts already learned (OWL, Literacy Teacher Site).

Juliebö and Durnford (1999) conceived the idea of applying the concept of narration to the organization and presentation of the OWL Web site's content. It consists of stories that follow a linear and sequential pattern. This particular configuration allows for the creation of an easy-to-understand use of the material that makes reading enjoyable and facilitates the achievement of language understanding. In addition, the sequential organization facilitates the incorporation of familiar contexts to present the use of the language in meaningful ways, and the incorporation of rich-textual information to promote the appreciation and habit of reading (pp. 7, 8).

The use of the computer as a tool to enhance instruction

Who lives with us here at school:
a project to learn about ecology at Brookside Primary School

This project delivers a unit of instruction that is supported by the use of the computer to enhance the student's understanding of ecology through the students' accessing to the Internet to obtain relevant information and to communicate with students from other schools. As a result, Feldman et al. (2001) note that they are able to understand environmental phenomena spatially and temporally by comparing the phenomena that occurr at their local site with that at other schools' sites and by using data that have been collected over the years. The strategic use of the Internet in the classroom allows the students to achieve new curriculum outcomes, such as the intelligent use of resources and the understanding of research activity (pp. 42-47).

Kids 'N Music:
a project to learn about music in connection with other areas of the curriculum

This material offers instruction in particular musical forms such as the Blues and Salsa to engage students in interdisciplinary studies. It was created in 1999 by Co-nect, an organization using technology to enhance

elementary education. It is project-based; the learning experience is mostly determined by the learning process itself. By using research resources such as the Internet, CD-ROMs, and video and audio recordings, the students investigate these types of music to create their own textual, visual, and audio material, which is stored on CD-ROMs to be shared with students from other schools. As a result, students develop reading, writing, mathematics, music and other important skills that are in accordance with state and local educational goals (Slowinsky et. al, 2001, pp. 32-49).

1.2 Children's cognitive development

To understand how children's adaptation to their environment through mental activity occurs, for the later creation of intelligibly visual messages, two theories and one perspective on cognitive development have been studied. These are the theories of Jean Piaget and Lev Vygotsky, and the Information-Processing approach based on the work of Richard Atkinson and Shriffin (Shaffer, 1999, pp. 270-273).

Piaget's work, during the first half of the twentieth century, led him to create new theories for understanding cognitive development (Cowan, 1981). Piaget and Inhelder (1969) defined cognitive development as a self-directed and active process stimulated by children's constant need to understand their environment. In addition, their identified specific phases that were characterized by the children's particular ways of knowing about their world (pp. 152-159). The cognitive theory elaborated by Vygotsky (1978) highlighted the socio-cultural aspects of intellectual growth (p. 124). As with Piaget's notion, Vygotsky viewed cognitive development as a dynamic and inquisitive process of knowing, but he described it as being stimulated by social interaction and characterized by the beliefs, values, and tools of thinking that children received from their culture (Shaffer, 1999, pp. 259-268). Later, in the 1960s, a group of psychologists, through observing how computers processed information, offered a descriptive view of intellectual activity and the mechanisms prompting development. Today, the knowledge gained from their work is known as the Information-Processing approach to cognitive development (Kail, 1998, p. 168; Shaffer, 1999, p. 271).

Jean Piaget, theory of cognitive development

Piaget attended to the universal rather than the individual and cultural aspects of cognition to explain how the activity of knowing developed (Maier, 1978, p. 167). Piaget and Inhelder (1969) defined cognitive

development as a dynamic process prompted by children's own desires to know about their physical and social world. They noted that this process was 'constructivist,' that is, children built understanding though using their mental abilities and schemes to relate the new to their previous awareness of things (p. 3). Piaget and Inhelder (1969) also qualified and individualized the particular ways of understanding through considering four distinctive intellectual stages of development: sensorimotor, pre-operational, concrete operational, and formal operational.

Three concepts, adaptation, organization, and equilibration, have been defined by Piaget to explain his constructivist theory of periodic and qualitative intellectual development (Shaffer, 1999, pp. 229-233).

Adaptation, organization and equilibration

Adaptation and organization are the processes involved in children's construction of understanding. Equilibration particularly occurs when children reach a new cognitive stage of development (Shaffer, 1999, pp. 232-233).

Piaget (1981) defines adaptation as the constant intellectual effort that children make to understand their environment, a process that involves assimilation and accomodation. Through assimilation, children refer to their previous knowledge and experience in order to understand a new event. He notes that "assimilation is that aspect of adaptation which conserves form or organization" (p. 4). To accommodate is to change an earlier awareness of things in order to understand the external situation. Piaget explains that accomodation occurrs when "the schemes (mental structures) are not adapted to the new object and must be modified" (p. 5).

Piaget defines organization as the regular process consisting of combining and reorganizing existing mental patterns into more complex structures. Through mental organization, children acquire more effective abilities for understanding (Shaffer, 1999, p. 232).

Piaget (1981) defines cognitive equilibration as the harmonious relationship between children and their environment (p. 4). Equilibration is the process of revising and reorganizing existing mental structures into new patterns that offer children a satisfactory way of understanding things (Kail, 1998, p. 143). Thus, the cognitive phases of development are temporal states of equilibration. Kail identifies them as follows:

Stage of Development	**Age Range**
Sensorimotor	Infancy *(0 to 2 years)*
Preoperational	Pre-school and early elementary school years *(2 to 6 years)*
Concrete Operational	Middle and late elementary school years *(7 to 11 years)*
Formal Operational	Adolescence and adulthood *(11 years and older)*

For the purpose of this thesis, the discussion focuses on the principles of cognitive development characterizing the *Concrete Operational* stage comprinsing the ages between 7 and 11 years.

The Concrete Operational stage

Piaget and Inhelder (1969) state that in the concrete operational phase, children are able to perform mental operations for thinking about their world. Mental operations are internal processes through which children alter and reorganize their images and symbols in order to achieve a logical conclusion (pp. 92-101). They note that these operations are named 'concrete' because children apply them to real and familiar objects. Children are not yet able to think about abstract and general ideas (p. 100).

The following description of various intellectual activities that children are able to perform at this stage of cognitive growth provides the premises to support the design of the instructional aid.

PERCEPTION OF THINGS

According to Maier (1978), Piaget mentions that at this stage, children are capable of ordering their thoughts by beginning to abstract and conceptualize their understanding of things from their experiences with the world. However, he also argues, "within their cognitive modes of thinking, ordering is still done one experience at a time with the aid of a concrete model" (pp. 56, 57).

Piaget and Inhelder (1969) describe some mental abilities that children perform as a result of applying logical thinking, including the ability to distinguish and relate ideas and the ability to organize ideas related to objects by seriation.

As noted by Piaget and Inhelder (1969), as a result of being able to identify, connect, and modify objects according to a specific method, children have acquired the notion of 'conservation.' He explains this notion through an example consisting of having children observe when a liquid is poured from one container to another that differs from the first in shape

and size. After the observation, children are able to conclude that the volume of liquid remains the same as a result of mentally visualizing the two containers and the liquid being poured back into the original container. Through this internal thinking, they realize that no more liquid was added during the experiment (pp. 97-99).

By mastering seriation, children are capable of arranging objects according to their different sizes. Piaget and Inhelder (1969) note that this task involves the mental visualization and ordering of objects through applying a formal method that establishes that the element that follows in the series is larger than the preceding one and smaller than the next, or the other way around (pp. 97-102).

PLAY

Piaget (1962/1969) defines play as an activity that has an important role in the evolution of intelligence. Moursund (1976) defines *intelligence* as the ability to think abstractly, that is the ability to elaborate concepts. To be intelligent means to understand, to associate, to construct, and to evaluate concepts or ideas. The author later introduces the notion of intelligent behavior as the ability to demonstrate intelligent thinking by performing actions. This definition also embraces the ability to judge an appropriate and effective behavior as a result of particular circumstances (p. 176).

Piaget (1962/1969) notes that between the ages of two and seven or eight years old, play involves children's adaptation to their environment, an activity dominated by the intellectual process of assimilation, that is the understanding of a situation based on previous knowledge and experience. He defines play as a symbolic activity, one through which children recreated familiar situations, that is based on children's own understanding and desires. In addition, symbolic play, during this age period, gradually becomes a more complex and a social activity (1962, pp. 287-291; 1969, pp. 128-129). During the Concrete Operational stage, Piaget (1962) states that symbolic play becomes objective, including games of construction and games with rules. The objects which children build or create through playing are analogous representations of objects, events or situations of their world (p. 288). Games that follow pre-established plans that every child understands and attends to engage children in playing with others; therefore, this evolution of play, from a symbolic to an objective activity, involves the children's process of socialization through development (Piaget and Inhelder, 1969, pp.117-122).

L.S. Vygotsky's socio-cultural theory

Vygotsky (1978) created a theory of human growth based on the consideration of socio-cultural factors. He defined cognitive development as an active process of constant exploration affected by social interaction and the elements that children receive from their culture (pp. 121, 122).

Vygotsky (1978) differs from Piaget by attending to the influence of additional factors in child development: historical and cultural (external factors) and biological (internal factors). These factors affect human growth by determining two ways of human behaviour called elementary and higher structures respectively. While the former refers to behavioral patterns such as attention, sensation, perception, and memory based primarily on biological conditions, the latter refers to these same basic patterns after being transformed into more complex forms of behaviour as a result of the influence of external factors (p. 124). Based on this assumption, Vygotsky argues that cognitive development is stimulated and influenced by social interaction that occurs in particular cultural contexts rather than being a self-guided process of seeking understanding as suggested by Piaget (Shaffer, 1999, pp. 259-268).

The two main concepts defined by Vygotsky used in the design strategy for this project are: the *zone of proximal development,* which provides the notion of how learning can be supported by social interaction, and the *development of symbolism in drawing,* which gives the premises for the later visualization of the instructional message.

The zone of proximal development

Vygotsky (1978) presents the concept of the zone of proximal development to explain the relationship between the processes of development and learning. He identifies two levels of development: the actual developmental level, which is the intellectual activity that children are able to perform when working individually; and the potential developmental level, which is the mental ability that children demonstrate when working with more mature children or adults. Hence, the concept of the zone of proximal development is defined as follows:

> … the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (pp. 85-86)

Vygotsky (1978) states that learning activates the zone of proximal development. That is, when children do learning activities in cooperation

with others, a variety of internal developmental processes are activated. These processes, operating only through collaborative activities, are individually assimilated as the children's cognitive abilities move to a new stage of development (p. 90).

Development of symbolism in drawing

Vygotsky (1978) considers drawing activity in children as a preliminary stage in the development of written language. Learning to write in children evolves in the following fashion: from drawing things to drawing words.

Children start drawing things when they are able to speak. Their drawings are symbolic and analogous representations of their verbal speech. That is, these representations depict a certain degree of abstraction in order to communicate the essential concepts of things and resemble, to a certain degree, the visual appearances of objects and actions. These representations are called *first-order symbols* or *analogous symbols* (p. 115).

Later, children start drawing words that are understood as representations of the verbal expressions of things. These drawings are purely abstract representations of phonemes, being arbitrary and conventional associations between abstract representations and phonemes. These representations receive the name of *second-order symbols* or *arbitrary symbols* (p. 115).

While it is difficult to describe how the developmental process of writing that evolves from analogous symbols to arbitrary symbols occurs, Vygotsky states that "one thing only is certain—that the written language of children develops in this fashion, shifting from drawings of things to drawings of words" (p. 115). He goes on to argue the following:

> … the entire secret of teaching written language is to prepare and organize this natural transition appropriately. As soon as it is achieved, the child has mastered the principle of written language and then it remains only to perfect this method. (p. 116)

Information-Processing approach, based on the work of Atkinson and Shriffin

Kail (1998) notes that since the 1960s many psychologists have explored the field of computer science observing how information is treated in computer environments in order to understand and develop some ideas about cognitive development. This way of understanding human psychology is known as the *Information-Processing approach*, and today, it is currently one of the principal approaches to cognitive development (pp. 167-168).

This perspective on cognitive development has been seen as complementary to Piaget's theory since it offers knowledge that describes the cognitive activity and the mechanisms activating its development, while Piaget is concerned with the entire process of cognitive development describing it through the identification and characterization of particular phases (Kail, 1998, pp. 172-173).

The information obtained from studying the information-processing approach to be used for the development of this thesis project is extracted from the studies of R. Atkinson and Shriffin who, in 1968, developed the 'store model' to explain cognition (Shaffer, 1999, pp. 272-273). It represents the mind as a series of separated and connected units through which information is processed (Huitt, 2000, pp. 1-2).

Characteristics of this approach

Atkinson and Shriffin, as cited by Kail (1998), based their mental model on the identification of the principal components of a computer: the *computer hardware,* the physical material that comprises a computer, and the *computer software,* the programs that allow the computer to perform a task. Based on this analogy, human thinking is based on mental hardware, that is the neural structures that allow the mind to operate, and mental software, the systematic cognitive-processes accomplished to perform a particular task. Examples of these are the tasks of writing, performing an arithmetic operation, or finding the way to a specific place (p. 169).

Huitt (2000) states that mental hardware consists of three components: *sensory memory, working memory,* and *long-term memory. Sensory memory* is the mental space in which unprocessed and unanalyzed information is stored for a very short period of time. *Working memory* comprehends the actual mental activity and the information to be subsequently used. *Long-term memory* is the mental place reserved for permanent knowledge and experiences of the world (pp. 1-2).

Information-processing theorists believe that re-organization of mental schemes occurs in different forms at all ages: infancy, childhood, adolescence, and adulthood; they can interact or function independently within mental activity (Kail, 1998, p. 172). Two approaches to how cognitive development occurs have been studied in order to understand how children register, store, and process information at particular ages: *increased capacity of working memory;* and *more efficient strategies.*

INCREASED CAPACITY OF WORKING MEMORY

Shaffer (1999) presents the notion of limited capacity, one of the assumptions of the information-processing approach. The mind has a measurable and particular capacity for processing, at a certain speed, and storing information, which is increased through development (p. 272). As stated by Kail (1998), a greater amount of random-access memory allows a computer to store more information and to process more sophisticated software. Similarly, as children grow, their mental capacity increases so that they are able to perform more difficult mental and physical tasks (pp. 170-171).

MORE EFFICIENT STRATEGIES

Kail (1998) notes that children use mental strategies to perform specific tasks. A mental strategy is a particular way in which information is treated. According to the children's age, they are able to perform more or fewer effective strategies. Cognitive development occurs when children, by their own observations or by imitating others such as their peers, parents, adolescents, or teachers, try out new strategies to perform particular tasks (p. 170).

Based on the studies presented above, some concepts of cognitive development can be considered for supporting the effective creation of instructional aids.

Concerning the idea that children between 7 and 11 years of age are able to mentally visualize, modify, and relate objects through applying formal methods, concepts to be learned that are particularly connected can be represented through coherent and clear configurations of elements that facilitate the understanding of the content (Piaget, 1969, pp. 92-101). In addition, given that children are able to conceptualize at the concrete level, information can be represented through familiar and real-life images, articulated in familiar and real situations (Maier, 1978, pp. 56-57). These familiar images in familiar situations can be treated as analogous representations of concepts to imitate the way through which children start representing things. Concerning Vygotsky's notion (1879), children's first representations of speech during the development of writing language consist of drawings that depict, in particular ways, their main ideas of things (p. 115).

According to Piaget (1962/1969), during cognitive development, play, an activity that increasingly involves the interaction between children in particular ways, contributes to the children's process of socialization

(pp. 117-122). Therefore, the conception of an instructional aid to be used for guiding group-play activities may contribute to the creation of rich and effective instructional situations.

Vygotsky's idea (1978) about an existing zone of proximal development that is activated when children work with the assistance of competent peers or adult, can underline the creation of an instructional message that allows the teacher to guide the children effectively in the achievement of specific outcomes (pp. 85-86).

According to Kail (1998) and Shaffer (1999) the information obtained from the information-processing approach suggests that children's ability to process and store information during cognition is limited. In addition, children use mental strategies that are considered as effective in terms of their ages. Thus, in order to facilitate the perception, retention, and understanding of concepts, a simple, orderly, coherent, as well as relevant configuration of information can be created to enhance and facilitate the understanding of a message (Kail, 1998, pp. 171-172; Shaffer, 1999, pp. 272-273).

1.3 **Musical understanding**

In this thesis, musical understanding is defined as the achievement of musical skills and knowledge of concepts through experiencing music in various ways during elementary education. In a document for Canadian Music Education, *Achieving Musical Understanding – Concepts and Skills for Pre-Kindergarten to Grade 8,* Garden (2000), as cited by the Coalition for Music Education in Canada et al; notes that music understanding is "the ability to apply knowledge and concepts appropriately in new situations" (p. 8).

> It (musical understanding) involves:
> - demonstrating,
> - explaining,
> - generalizing,
> - generating new ideas,
> - internalizing,
> - interpreting,
> - representing in new ways,
> - making informed musical judgements, and
> - transferring what has been learned to new contexts.

In the document mentioned about, the achievement of musical skills and knowledge of concepts is based on eight notions. Three of them are considered as relevant for the design of the thesis project.

- *Music learning proceeds best through a sound before symbol process*
  Certain experiences are essential in the education of music. That is, "making, creating, presenting, and responding to music provides the foundation for subsequent experiences with reading and writing music and for conceptual development" (p. 9).
- *Music is experienced in a number of ways*
  Music is experienced through singing, playing, moving, composing, improvising, listening, and reading and writing music notation. These musical experiences are adjusted to the different levels of education. The authors state that "a balance of musical activities contributes to musical understanding" (p. 9).
- *Through multiple experiences in music children develop a variety of skills to promote understanding of music concepts*
  By experiencing music in many ways, children develop skills in perceiving, understanding, connecting, creating, making, reflecting, responding, and presenting music. Specifically, children use these skills to learn about the musical concepts—rhythm, melody, dynamics, timbre, form, and texture. This learning process, as characterized by the authors, occurs "in a spiral and sequential progression and in increasingly challenging contexts" (p. 10).

Listening maps

Listening maps are generally used for introducing grade 1, 2 and 3 students to the interpretation, understanding, recognition, and enjoyment of music by naturally associating familiar images with unfamiliar sounds. The listening maps are used to teach the identification and understanding of musical concepts by listening to particular musical pieces. A listening map is a spatial arrangement of images and iconic symbols that represents, in a particular way, the musical pattern described by a musical piece.

In a class situation, the teacher introduces the musical concept to be taught through engaging students in playing, moving, reading and writing activities. For example, to teach the musical concept of *accent,* the importance given to an individual musical sound by performing it with more force, the teacher draws some rhythmic patterns with different accentuation in the blackboard to have the students clap those particular rhythms. As well, the students read some rhythms with different accentuation out loud by echoing those performed by the teacher. The

teacher introduces the listening map that represents the musical concept being taught when the students are ready to understand it through listening to a particular piece of music. In this regard, the teacher points to the symbols and images on the map as the music plays, repeating this activity many times until the students are able to follow the map alone. This listening and responding activity is followed by the creation of the children's own written representations of simple and short accentuated-rhythms to after that, perform them in front of the class.

Content of music to be taught

Based on the document cited above, the unit of music considered for developing the instructional aid comprises the skills and knowledge of concepts that grade 2 level students achieve through engaging in different musical activities. The unit's content is detailed below as the general student achievements concerning the experiences of *playing and moving with, listening and responding to,* and *reading and writing music;* and the specific musical concepts of *beat/tempo, rhythm,* and *form.* [1] These general student outcomes are achieved through the musical activities that the teacher carries out with the support of the material to be developed.

Experiential achievements

By playing with music, students will:
- play expressively
- play alone and with others, following the directions of a conductor

By moving with the music, students will:
- use movement to demonstrate musical concepts

By listening and responding to music, students will:
- share responses to a wide variety of music—both live (vocal and instrumental) and recorded, from many cultures, styles, and eras
- identify and demonstrate an understanding of grade appropriate music concepts through listening

By reading and writing music, students will:
- recognize and demonstrate connections between sound and symbol
- use iconic and symbolic graphic representation of musical sounds

Conceptual achievements

Beat/tempo
- identify and respond to beat by singing, moving, listening, using body percussion (clapping, tapping, stepping, etc) and classroom instruments

---

[1] Notes at the end of this section

- keep a steady beat while making or listening to music
- continue to identify and respond to the difference between beat and rhythm
- identify and respond to simple duple (2/4, 3/4)
- read and write rhythmic patterns using iconic representations

Rhythm

- identify and respond to rhythm patterns by singing, moving, using body percussion and classroom instruments
- read, write, recognize, and use the note values and rests taught in the previous grade, such as the quarter note, eight note, and quarter rest, adding the half note value using traditional and stick notation and rhythm syllables
- sing, listen, and move to other rhythms, note values, and metres in songs, listening selections, and movement activities

Form

- demonstrate understanding of the different musical forms through singing, playing, listening and moving (Coalition for Music Education in Canada et al; 2000, pp. 33-36)

1.4 **Analysis of existing listening maps**

Basis of analysis

The following comprises some visual principles of communication and multimedia design, and visual techniques for the analysis of existing listening maps and for the later creation of the computer-based aid.

Basic visual elements

Dondis (1974) defines the basic visual elements as the basic substance of all visual compositions, presented in different combinations and with distinctive levels of visual importance. These elements are dot, line, shape, direction, dimension, motion, proportion, colour, tone, and texture. The basic visual elements constitute a language that the designer uses for conveying meaningful and powerful messages. Dondis states that the basic visual elements "have the dramatic potential for carrying information with simple directness and ease, messages that are effortlessly understandable to anyone who can see" (pp. 65-66).

Visual principles

Carlson et al. (2000) presented the gestalt theory of visual perception, the theory of the form, that was enunciated in the early twentieth century by a group of German psychologists. The gestalt theory proposes that human beings perceive objects as a result of the intellectual organization of stimuli into individual and concrete configurations. The principles governing the organization of elements in a visual field are stated as follows:

PRINCIPLE OF PROXIMITY

The principle of proximity determines that elements that are closely located in a visual field are perceived as belonging to the same compositional unit or figure.

PRINCIPLE OF SIMILARITY

The principle of similarity determines that elements presenting similarities in their visual variables are perceived as connected.

PRINCIPLE OF GOOD CONTINUATION

The principle of good continuation determines that elements that are arranged in a visual field as if they were following a simple and even outline are perceived as a figure, despite other possible ways of grouping elements suggested by more complex compositional-patterns.

PRINCIPLE OF CLOSURE

The principle of closure determines that elements missing from the implied contour of a figure are 'created' to fill the blank.

PRINCIPLE OF COMMON FATE

The principle of common fate determines that elements that represent the same directional movement in a visual field are perceived as being part of the same figure (pp. 208-209).

Visual techniques

Dondis (1974) notes that the visual techniques are the particular methods applied for creating a visual composition by responding to the intention of communicating specific meanings. These methods or visual techniques are considered between two extremes or poles, that are *contrast* and *harmony.* The visual techniques of contrast are used to create visual unlikeness, distinctiveness, dynamism, and emphasis, while the visual techniques of harmony are used to create visual simplicity, stability, quietness, and coherence (pp. 107-127).

Principles of multimedia design

Mayer (2001) defines seven principles for multimedia design based on research in cognitive learning from multimedia environments. Three of them have been studied for their application to the thesis project.

Principle of spatial contiguity

The spatial contiguity law determines that "students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen" (p. 81). This principle is based on the assumptions establishing that students process visual and verbal information through separate channels, that have limited capacity. In addition, cognitive processes such as selecting, relating, and organizing are stimulated during the assimilation of meaningful information. Later, considerations such as visual synthesis, and spatial arrangement of related pictorial and verbal information are significant for the design of intelligible messages (pp. 94-95).

Principle of temporal contiguity

The notion of spatial proximity is applied to the temporal arrangement of visual and verbal information. The author states that "students learn better when corresponding words and pictures are presented simultaneously rather than successively" (p. 96). In terms of design, this means that temporal articulation of necessarily narrative and animated information facilitates meaningful learning (pp. 111-112).

Principle of coherence

The coherence law establishes that "students learn better when extraneous material is excluded rather than included" (p. 113). The author notes that difficult learning results from adding interesting by irrelevant visual, verbal, and aural information to multimedia messages. Conversely, learning is enhanced when unnecessary information is eliminated from the message. Therefore, visual clearness, simplicity, and relevancy are key aspects in the design of messages that facilitates meaningful learning (p. 113).

Effective and ineffective design of listening maps

One of the editorial companies that develops material to teach music literacy concerning the North American primary-school standards, is the McGraw-Hill School Division. It specifically produces a variety of listening maps to be used with grade K-6 students, which are provided as transparency sheets for their use in the classroom.

The following is an analysis that concerns the visual aspects of specific McGraw-Hill listening maps developed for grade 2 students. This analysis highlights the strengths and weaknesses of the design of the listening maps representing some musical pieces from *The Nutcracker* suite by Piotr Ilyich

Tchaikovsky. These musical pieces are the *Overture, Dance of the Sugar Plum Fairy, Chinese Dance,* and *Waltz of the Flowers.*

The design strategies considered as effectives result from defining the components and visual system/organization of the information.

Components

- the use of visual elements such as shape, colour, tone, texture, etc. to present and differentiate information (Dondis, 1974, pp. 65-66)
- the use of analogous symbols, images that resemble to a certain degree the visual appearances of objects, for representing the musical concepts (Vygotsky, 1978, p. 115)

Organization

- the linear and spatial sequencing determined (from left to right, and from the top to the bottom) to facilitate reading of the material, and to resemble the visual arrangement and reading sequencing of the musical scores (Juliebö and Durnford, 2000, pp. 7, 8)
- the repeated use of analogous symbols to represent repeated units of music. Based on the Piaget's definition of concrete operational thinking, this strategy is considered to be effective as a result of addressing a concrete or familiar representation of music (Maier, 1978, pp. 56-57)

On the other hand, some ineffective strategies are observed in the components and organization systems defined for presenting the information.

Components

- THE NEED FOR SIMPLE AND RELEVANT INFORMATION

  In the *Dance of the Sugar Plum Fairy* listening map, each analogous symbol represents a particular melody pattern comprising 4 units of rhythm or 4 beats of the music (figure 1). These symbols are visually differentiated without presenting a clear association with the different melody patterns of the dance. For example, in the first phrase of the dance, the image of a ballerina used to represent a melody of 4 beats is repeated by differentiating her dress or her colour and shape of her hair. As a result, it is difficult to associate this visual distinction with the different melody patterns described by the music. This analysis was based on the coherence principle determining that visual clarity, simplicity, and coherence encourage meaningful learning (Mayer, 2001, p. 113).

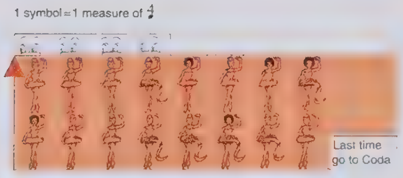

figure 1

Organization

- THE NEED FOR VISUAL ORDER

In the *Chinese Dance* listening map, the music is organized into phrases of 8 units of rhythm or 8 beats. Each 8-beat musical phrase is represented with a group of elements that are arranged in a confused and difficult-to-perceive composition. As an example, the first phrase is represented with the image of a flute in a diagonal position representing the particular sound, *timbre,* of the *melody* performed by this instrument. Two curved up-and-down arrows displayed at both sides of the flute's image represent the melody pattern (figure 2). The textual information, *8 beats,* that is displayed at the bottom of these three elements already mentioned completes this composition. A clearer alternative to it would be to have a linear (horizontal) and sequential arrangement of these four elements. It would consist of presenting the image of the flute first representing the timbre of the music, that would be followed by the arrows illustrating the *melody* and the textual information indicating the *8 beats* comprised by this musical phrase. The notion of linearity and sequence was applied for the organization of symbols with different levels of abstraction, such as the image of a flute that presented higher iconic level than the arrows and the verbal information, into an intelligible configuration (Juliebö and Durnford, 2000, pp. 7, 8).

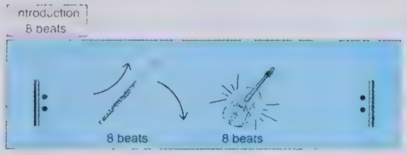

figure 2

- THE NEED FOR VISUAL CRITERIA

In the *Overture* listening map, distinctive analogous symbols are used to represent different melody patterns. On the other hand, each of these patterns is used to represent either an 8-beat or a 16-beat rhythmic unit. That is, an image of a soldier is used to represent 8 beats while an image of a pine is used to represent 16 beats of the music. As well, these analogous symbols are distributed on the visual field by assigning to them equal dimensional spaces (figure 3). This analysis was based on the gestalt principle of similarity to state that elements presenting equal features in their dimension are perceived as connected (Carlson et al; 2000, pp. 208-209).

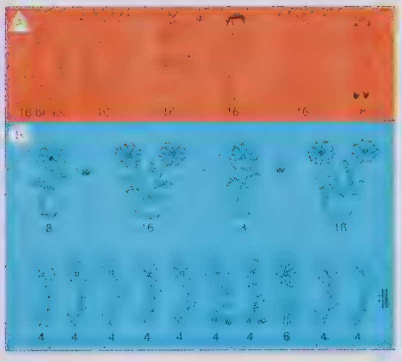

figure 3

- THE NEED FOR LAYERING INFORMATION TO IDENTIFY DIFFERENT MUSICAL CONCEPTS

In the *Waltz of the Flowers* listening map, one analogous symbol, an image of a flower, is used to represent 3 beats. At the same time, this image presents distinctive visual features to illustrate a particular melody pattern of the waltz (figure 4). A clearer alternative to this

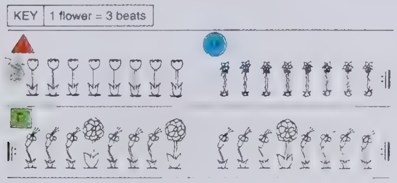

figure 4

would be to have two images organized in two layers of information, one representing the beat and the other representing the melody of the waltz. Based on the multimedia-learning principle defining that students process information through individual channels with limited capacity, one can conclude that presenting clear and organized information will facilitate its understanding (Mayer, 2001, pp. 48-49). As well, based on the principle of proximity, students will connect information that is close to each other in the visual field (Carlson et al; 2000, pp. 208-209).

[1] *Beat/tempo* is the steady succession of units of rhythm in music.
Rhythm is the pattern of musical movement through time.
Form is the design, structure, or pattern of music. In comparison with *melody,* the musical pattern described by the arrangement of single notes, *form* is the musical pattern or structure with respect to the entire musical composition, the arrangement of distinctive patterns (The American Heritage Dictionary of the English Language: Fourth edition, 2000).

Design strategy:
definition of the suitable instructional environment, instructional situation, and instructional message

Based on the literature review and analysis of existing listening maps, the design project consists of developing an animated listening map to aid the teaching of the musical concepts of beat/tempo, rhythm, and form to grade 2 level students. An *animated listening map* is a spatial arrangement of images, on the computer screen, that changes over time to respond in a particular way to the musical pattern described by the musical piece being played on the computer.

The following text defines the general and specific design objectives. The latter are based on relevant premises derived from the literature review, and on the description of the specific medium, and communicative situation, that are considered for the creation of the instructional aid. The information presented on page 41 shows the relationship between the relevant literature-based premises, and the design objectives. It provides the rationale for the definition of the visual system later created.

2.1 General design objective

The general design objective is to create an instructional situation through which the teacher and the learners interact with the information presented on the screen to teach and achieve musical understanding, and to determine the software program's configuration and the visual system for presenting the instructional message on a video screen to grade 2 children.

2.2 Specific design objectives

Premises based on the literature review

Premises based on the literature review underlie the definition of the specific design objectives concerning the creation of the instructional environment (formed by materials and equipment), the instructional situation (consisting of interaction among people), and the instructional message.

Learning environment: creation

- effective use of the computer's capabilities in the creation of familiar, easy-to-understand, and engaging learning environments to facilitate and enhance the processes of teaching and learning new knowledge and experiences (Juliebö and Durnford, 2000, pp. 7, 8)

Instructional situation: creation

- projection of an instructional situation in which the teaching and learning activities performed with the aid of the computer are well

integrated with the usual instructional activities
(Coalition for Music Education in Canada et. al, 2000, p. 9)

- projection of an instructional situation in which the interaction between the teacher and the students, and the instructional message, allows the incorporation of group-play learning activities (Piaget, 1969, pp. 117-122)

Instructional message: meaning

- representation of concepts through concrete models; that is, the use of familiar, friendly, and charming images representing real-life situations to illustrate the main idea of subject-matter concepts (Piaget and Inhelder, 1969, p. 100; Maier, 1978, pp. 56-57)
- use of analogous symbols to represent concepts or ideas (Vygotsky, 1978, p. 115)
- conception of an instructional message that helps students working under teacher guidance to achieve specific grade-2-level outcomes (Vygotsky, 1978, pp. 85-86)

Instructional message: configuration

- establishment of a linear and spatial sequencing (from left to right, and from top to the bottom) of the visual elements to resemble the musical scores' configuration and way of reading
- application of principles of perception to create an orderly, simple, clear, and coherent visual configuration of the instructional message (Piaget, 1969, pp. 92-101; Carlson et al; 2000, pp. 208-209; Mayer, 2001, pp. 112-113, 114)
- use of visual resources to organize, differentiate, and associate information within the visual field or computer screen (Dondis, 1974)

Definition of the medium

The computer, the medium chosen for presenting the instructional message to the teacher and students in the classroom, is used as a multimedia device. It is used to present text, graphics, video, animation, and sound in an integrated way by using a particular software program. Specifically, this computer's capability of presenting visual and aural information articulated across a period of time allows the presentation of concepts in ways that benefit the teacher in motivating the students' participation and in facilitating the understanding of some specific musical concepts.

The digital display of images

IMAGE RESOLUTION

The resolution of an image refers to the sharpness and clarity of its digital display. It is determined by the computer screen's resolution, the number of pixels to make up an entire screen, and the internal computer's representation of an image (Heines, 1984, p. 5). The computer's screen resolution depends on its size that is measured in inches (from one to the opposite corner) diagonally (http://www.webopedia.com).

Digital colour of an image

The colour of an image depends on the graphic capabilities of a computer monitor, the video system and video memory existing in a computer. Colour monitors are RGB devices that reproduce colours by lighting the screen's pixels through red, green, and blue phosphors. Modern colour monitors are capable of displaying from 16 to over 1 million different colours. In order to display a certain range of colours on the screen, the monitor, the video system, and the video memory available should be capable of supporting those specific colours (http://www.webopedia.com).

Definition of the communicative situation

The definition of the communicative situation involves the description of the instructional message and the instructional environment. The latter description specifically refers to the music classroom, the physical space utilized for the teaching and learning of music.

Instructional message

The instructional message specifically consists of a spatial and temporal arrangement of analogous and arbitrary symbols on the computer screen that represent, in a particular way, the musical concepts of beat / tempo, rhythm, and form of the musical piece being played by the computer.

Instructional environment

In order to describe the instructioanl environment, it is important to address the physical space, the music classroom, where the teacher and the students interact to respectively teach and achieve musical understanding. The music classroom is usually an individual room where students participate in the instruction of the music subject. Nye et al. (1992) depict it emphasizing the good quality of the music environment that is achieved through proper ventilation, comfortable temperature, and adequate lighting of the room. As well, it is important to consider the arrangement of the

space with respect to the performance of different grade-level activities and the class routine. Thus, for the primary level children that mostly perform playing and moving activities, an open floor space with movable objects is needed. Visual stimuli configuring the music environment can consist of the following:

> … a drawing of the keyboard, pictures of instruments and musicians, charts of hand signals, rhythm syllables, note values, and texts of songs posted on big sheets of butcher paper. (p. 69)

The teacher, who can be either a music specialist, teaching the subject of music, or the teacher responsible for all subject areas of the curriculum, is the person that arranges and configures this physical environment. She or he considers the creation of a working space appropriate for all grade-level activities that allows students to experience music in a variety of ways.

Definition of the specific design objectives

These design objectives follow the same criteria applied for presenting the literature-based premises—the design objectives are statements concerning what the design solution should accomplish.

Learning environment: creation

- represent the concepts of beat/tempo, rhythm, and form through a linear and sequential animation of images and symbols that are well synchronized with the sound/music performed by the computer (Juliebö and Durnford, 2000)

Instructional situation: creation

- represent the concepts of beat/tempo, rhythm, and form through a simple animation pattern that is used as a model of musical representation to guide play, movement, and reading and writing activities (Coalition for Music Education in Canada et. al, 2000)
- represent the concepts of beat/tempo, rhythm, and form through the visualization of playful, active, amusing child-like activities (Piaget, 1969, pp. 117-122)

Instructional message: meaning

- represent the music concepts of beat/tempo, rhythm, and form through the use of analogous symbols—images that resemble, to a certain degree, the visual appearances of objects that are presented

in concrete, simple, familiar, and real situations (Piaget and Inhelder, 1968, p. 100; Maier, 1978, pp. 56-57, Vygotsky, 1978, p. 115)

- represent the concepts of beat/tempo, rhythm, and form with a clear, simple, well-organized, attractive, charming, and ingenious visual composition (Vygotsky, 1978, pp. 85-86)

Instructional message: configuration

- represent the concepts of beat/tempo, rhythm, and form through a linear and sequential animation of analogous and arbitrary symbols
- present an orderly, simple, clear, and coherent visual composition of analogous and arbitrary symbols, that has been achieved through the application of the gestalt principles of visual perception, and the principles for multimedia design (Piaget, 1969, pp. 92-101; Carlson et. al, 2000, pp. 208-209; Mayer, 2001, pp. 112-113, 114)
- present visual information through the use of the basic visual elements, that has been organized/related and differentiated through respectively applying the visual techniques of harmony and contrast. [1]

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[1] The repertoire of visual techniques that can be approached for representing the specific musical concepts are the following:

Visual techniques of contrast: spontaneity, activeness, accent, and variation.

Visual techniques of harmony: balance, symmetry, regularity, unity, economy, consistency, sequentiality, and repetition (Dondis, 1974, pp. 107-127).

The design proposal consists of a proposed *animated listening map* that is supported by a software program that presents animated images and music, in an integrated way, on a display screen to aid in the instruction of the identification and understanding of musical concepts of grade 2 students. Specifically, it is a particular animated representation of the musical concepts of *beat/tempo, rhythm,* and *form* depicted by the *Chinese dance,* a musical piece from *The Nutcracker* suite composed by Piotr Ilyich Tchaikovsky.

With respect to the instructional situation, the animated listening map is specifically used to guide listening and responding activities, even though it is also conceived as a tool for guiding other musical activities such as playing and moving with, and reading and writing music. In order to use the animated listening map in the classroom, the computer containing the animation file is connected to a projector or large screen and to adequate speakers so that the students are able to suitably perceive (visually and aurally) the instructional message.

As a result of responding to the general and specific design objectives, the following are the descriptions of the animated listening map—in terms of the particular computer application used to develop it, the configuration of the animated listening map, and the visual communication system created.

3.1 Flash 5: construction of the animated listening map

The software-program application used to create the animation is Macromedia® Flash™ 5, which is the professional software standard for creating animated software programs for the Web (Macromedia® 2000, p. 9). It makes the computer present animated images and sound on a display screen that are well integrated over a specific time period. It determines the basic elements used to make up the entire animation: the file format, the image, colour, and sound.

File format

In order to display the animation on a computer, the information is stored under the Flash player file format (shockwave file: swf). This specific file format is displayed either as an individual animation or program, or as part of a Web site. In both cases, a movie-player application is needed. The main application created to support Flash player animations is macromedia® Flash player, others being QuickTime Player, Real Player, Veon Player, etc. In addition, the Macromedia® Flash player application is

pre-installed in most browsers and on most operating systems. Examples of these are the Microsoft Internet Explorer 5.5, 6.0 (for Windows) and 5.0 (for Macintosh), Netscape 6 and Navigator/communicator, America Online browsers, and others; and the Windows 98 and Windows XP, Macintosh (with system 8.1 and above) operating systems, and others.

The file format comprises the particular image, the colour palette, and the sound file of the animation.

Image

The computer presents images in two formats—vector and bitmap images. A vector image is made up of points determining lines and curves that also contain information about the image's colour and position. A bitmap image is created by coloured dots or pixels, that have specific locations within a grid (Macromedia® 2000, pp. 68, 69).

The images created for the animation consist of vector images. For example, the image of a beat bar is created by a spatial arrangement of points determining the image's configuration or outline, position, and particular colour of the area enclosed.

Colour

The colours used for the animation correspond to the Web-safe 216 solid-colour palette, a colour palette that can be displayed by any operating system capable of managing 8-bit colour information or higher. These colours are identified with a 6-symbol code specifically consisting of numbers and letters.

Sound

The sound is stored and processed by the computer as digital-sound information with a specific format. The format corresponding to the sound used for the animation is MP3, a file format that compresses digital-sound information for its optimum use on the Web.

3.2 **Configuration of the proposed animated listening map**

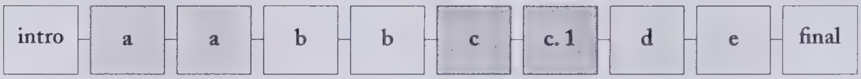
The configuration of the material describes the format (size and shape) of the screen display and the animation map representing the temporal arrangement of the animation shots.

Screen's format

The display's size of the animation is measured in pixels determining a rectangular display's shape that is 640 x 480 pixels.

Animation map

The animation map depicts a linear and sequential arrangement of the animation shots.



Intro and *final* corresponds to the first and last screen shots of the animation representing the introduction and final sound of the *Chinese dance; a, b, c, c.1, d,* and *e* identify the distinctive animation shots corresponding to the different musical patterns of this musical piece (see appendix A, pp. 64-71)

3.3 **Animated listening map**

Instructional message

The instructional message is depicted through a linear and sequential animation of analogous and arbitrary symbols on the computer screen that are presented in real and familiar situations representing the musical concepts of beat, rhythm, and form of the *Chinese Dance.* It is presented in two versions; the only difference between the two is the presentation of the notation symbols, which have been added in the second version for representing the rhythm. In this way, these two versions facilitate the understanding of musical concepts; the recognition, appreciation, and enjoyment of music; as well as the creation of group-play activities and other musical activities within the instructional situation.

To aid in the student's understanding of music, the animation of analogous and arbitrary symbols, in real and familiar situations, resembles the concrete thought structures with which children between 7 and 11 years old organize and understand their world. In addition, the linear sequencing of animated elements reflects the visual structure and reading sequencing of the musical scores. The students' understanding of music is also achieved with a well-organized, attractive, charming and ingenious composition that visually 'explains' with simplicity, clarity and order what the students perceive from the music and helps to motivate their attention and participation throughout the listening activity.

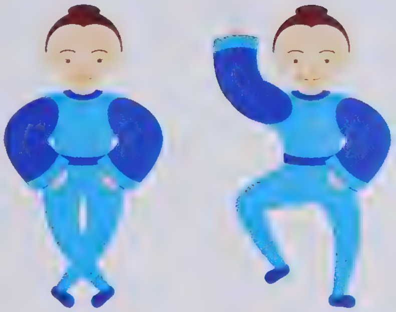
The aim of motivating students to recognize, appreciate and enjoy the musical piece that they are listening to is achieved through representing with analogous symbols significant elements suggested by the theme of the *Chinese Dance.* This makes the student enjoy and recall the dance through perceiving and mentally assimilating the familiar, amusing, and significant representation.

In addition to what has been said, an animation of a concrete, simple, playful, amusing, child-like situation is intended to inspire the creation of group-play activities and other musical activities within the teaching and learning situation. For example, the simple, playful, child-like *Chinese Dance* represented in the animation can give teachers the idea of creating

a step dance, that students perform in a circle, while listening to the music. Moreover, the teacher can ask the students read aloud the rhythm represented in the animated listening map.

Visual system

The visual system is comprised by the elements defined to create and organize the instructional message through the application of some visual principles and techniques. The visual system was designed attending to the analysis of the main goals of the instructional message.



Chinese boy symbol

Visual system: components

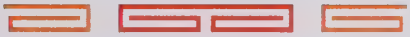
Image

The image includes the analogous symbols, arbitrary symbols, and the presentation of these symbols in concrete (real and familiar) situations.

Analogous symbols

Chinese boy

A happy, amusing, and child-like representation of a Chinese boy that appears dancing across the screen represents the rhythm and visually suggests the theme of the Chinese dance.



Beat bar

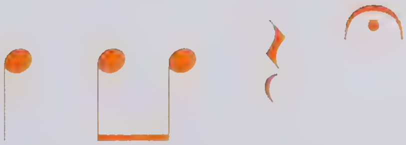
Beat bar

A particular rectangular-shape, imitating a Chinese design pattern, that is repeated across the screen following a linear pattern represents the beat/tempo of the musical piece and gives a Chinese appearance to the entire screen.

Background bands

Background band

A coloured rectangle containing a stripe of recreated beat bars—as if they were written with a pencil—that is located at the top and bottom sides of the screen represents the form of the musical piece by changing its colour over time. As well, its visual appearance contributes to the Chinese look of the screen layout.



Quarter note, eight notes, quarter rest and fermata symbol

Arbitrary symbols

Musical notes

Representations of the quarter note, the eighth note and the quarter rest values, and the fermata[1] symbol, corresponding to the notation system used for writing music, appear in the second version of the animated listening map under the linear arrangement of beat bars. This

notation represents the rhythm by being highlighted with different colours (red and blue) as the rhythm of the musical piece goes (see *colour* in the next page).

PRESENTATION OF THE IMAGE IN CONCRETE SITUATIONS

Chinese boy dancing across the screen

The concept of *rhythm,* the pattern described by the musical movement through time, is represented by the Chinese boy symbol depicting an animated linear dance—from the left to the right side of the screen. Afterwards, the distinctive dancing movements represent the different rhythmic units. When the Chinese boy crosses his legs and positions his arms on his hips, it illustrates a quarter note value. When the Chinese boy stands up on one of his legs, and rises the arm from the same side of his lifted leg, it represents an eighth note value. To represent the quarter rest value the Chinese boy symbol disappears from the screen (see appendix A, p. 63).

Linear arrangement of beat bars

Beat maps consists of linear arrangements of horizontal segments that the teacher draws on the board to illustrate the beat of particular rhythms that are written, with note symbols, above these segments. In the animated listening map, the concept of *beat,* the steady succession of rhythm units, is represented by successively highlighting with red each one of the orange beat-bars belonging to this linear pattern (see appendix A, p. 63).

Coloured background bands

The concept of *form,* the structure of the music determined by its distinctive melody patterns of phrases, is represented by the change of colours, over time, of the background bands corresponding to the particular melody patterns of the musical piece (see appendix A, p. 63).

[1] *Fermata* is the musical symbol written above the notation to indicate the prolongation of a tone, chord or rest beyond its represented time value. This symbol also indicates that the music being performed must be ceased or stopped (The American Heritage Dictionary of the English Language: Fourth edition, 2000).

Colour

Colour is used to help identify and relate information, and to create visual attraction within the composition. The colour palette presented below includes the necessary colours used for creating the animated listening map. The selection of colours is based on the *coherence principle* of multimedia design, that is, on the notion that an interesting but irrelevant use of information detracts from the creation of an intelligible message (Mayer, 2001, p. 113).

The colours, differing in their hues (the chroma of the colours) and saturations (the colours' degree of purity), are defined to create contrast and similarity within the composition (Dondis, 1974, p. 51). The blue colours, particularly the *dark blue* and *light blue,* identify the Chinese boy symbol with an elegant and distinctive costume. The *dark orange, light pink,* and *brown* complete this characterization of the Chinese figure by being applied to its face (contours of the eyes and mouth), skin (face and hands), and hair. As well, the blues already mentioned contrast with the oranges that are defined for the beat bars and the background bands representing the beat and form of the music. The *red* is used to give attention to each of the *orange* beat bars to represent the beat of the music. It is also assigned to the background bands, that turn from orange to red, to represent a change in the musical composition when more instruments are added and the end of the musical piece. In addition, the *red* and *blue* highlight and distinguish the note and rest values. The *red* is assigned to the quarter note and rest values, and the *blue* is assigned to the eighth note value. The background of the composition is kept *white* in order to guide the attention to the particular figures representing the musical concepts.

On the other hand, similarity is created to establish a particular visual hierarchy that facilitates the understanding of the message. The orange, with different degrees of saturation *(orange, light orange, and pale orange),* is assigned to the beat bars and background bands to be perceived as a unified configuration upon which the Chinese boy figure is presented. The *light orange* and *pale orange* are assigned to the background bands to represent minor changes in the musical patterns.

The brilliant, saturated, and distinctive colours defined create an amusing, attractive, playful, and cartoon-like composition.

⬜	white	FF	FF	FF
🟧	orange	FF	99	00
🟧	light orange	FF	CC	33
🟨	pale orange	FF	FF	99
🟧	dark orange	FF	66	33
🟥	red	FF	00	00
🟧	light pink	FF	CC	99
🟦	blue	00	00	66
🟦	dark blue	33	33	99
🟦	light blue	33	CC	FF
🟫	brown	66	00	00

Music

The musical piece, represented by the animated listening map, is the *Chinese Dance* from *The Nutcracker* suite, composed by Piotr Ilyich Tchaikovsky at the end of the 19th century.

Visual system: structure

Basic organization of the visual elements

The basic organization of the visual elements results in an orderly, simple, clear, and coherent visual composition achieved through the application of the Gestalt principles of *similarity* and *proximity.* As well, this organization of elements responds to the design principles of *temporal contiguity* and *coherence* for multimedia design. By *similarity,* for example, the beat-bars symbols and the background bands decorated with a stripe of beat-bars are perceived as a unified configuration, which becomes the background upon which the Chinese character is clearly identified. By *proximity,* the Chinese boy symbol is visually associated with the particular beat bar above which it is appearing. This spatial relation visually communicates that the rhythmic unit represented by the Chinese character occurs at the particular time-unit represented by the red beat bar (Carlson et al; 2000, pp. 208-209).

Visual simplicity, clarity, and coherence is also achieved through the application of the *coherence principle,* which determines that students learn better when unnecessary information is eliminated from the message. Based on this notion, the necessary visual elements and visual changes are used and created to significantly represent, in particular ways, the music. Concerning the notion of *temporal contiguity,* determining that students learn better when narrative and animated information is presented simultaneously rather than successively, the Chinese boy symbol dancing across the screen, the steady succession of beat bars, and the change of colours of the background bands occur at the same time as in the music. In the second version of the animated listening map, the notation added to represent the rhythm is integrated to this temporal and spatial organization of elements (Mayer, 2001, pp. 111-112, 113).

Organization, relation, and differentiation of the visual elements concerning the intended meaning

Visual organization and integration is achieved as a result of applying the visual techniques of *harmony,* which include balance, symmetry, regularity, simplicity and unity. Visual distinction and differentiation is achieved through the use of the techniques of *contrast,* that are spontaneity, activity, and variation.

Symmetrical balance

This method determines a central point in the composition around which elements are arranged in equal configurations. It is particularly used to arrange the beat bars and background bands that represent the beat and form of the music—the elements defining the structure of the music. According to a central and horizontal axis, the beat bars are arranged into two rows of eight rhythmic units or beats and the background bands are located at the top and bottom sides of the screen. This symmetrical organization of elements creates a regular, even, and natural structure guiding a clear representation of musical concepts.

Regularity based on sequence and repetition

In this particular case, sequence and repetition create a spatial unit that is successively repeated within the visual field. It is applied to create a composition that visually 'imitates' the configuration of music, which happens in a linear fashion, where different elements such as the melody, rhythm, and form are articulated based on an even succession of beats.

SIMPLICITY AND UNITY

Simplicity and unity are used for creating visual clarity and singularity, which facilitate the understanding of a singular musical concept through relating it to a musical composition.

SPONTANEITY

Through this technique, one element is articulated in the composition by disobeying, in some way, the established criteria. It is applied for creating visual emphasis so that musical concepts are perceived by visual differentiation. For example, the Chinese boy symbol, representing the rhythm, suddenly appears in the screen by 'altering' the visual regularity depicted by the even succession of beat bars.

ACTIVITY WITH VARIATION

These methods consist of representing movement as patterns that vary in relation to a basic configuration. These are applied to particularly represent the concept of rhythm and form. Both musical concepts are supported by movement patterns and melodic patterns, that change over time, in response to a dominant pattern. In the visual composition these musical concepts are represented through animated visual patterns that vary through time, but maintain their significant features.

Proposed animated listening map

Information providing the rationale for the definition of the visual system

Instructional message
It consists of a spatial arrangement of analogous and arbitrary symbols representing in a particular way the musical concepts of beat/tempo, rhythm, and form of the musical piece being played on the computer

Medium
It is the computer that is used as a multimedia device for presenting graphics, animation, and sound in an integrated way

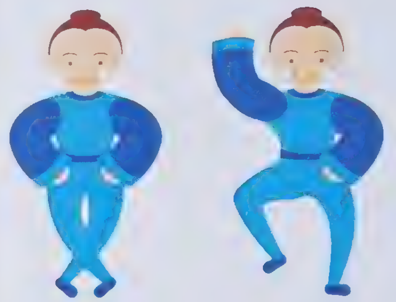
Audience
It is comprised of the music teacher and the grade 2 students

Instructional environment
It refers to the music classroom, an open space with carpeted floor where elements such as furniture, instruments, and objects are arranged concerning grade 2 level activities and class routine (Nye et al; 1992)

General design objective
To create an instructional situation through which the teacher and the learners interact with the information presented on the screen to teach and achieve musical understanding. Therefore, the objective of the design project is to determine the software program's configuration and the visual system for presenting the instructional message on a video screen to grade 2 children

Literature-based premises	*Specific design objectives*
Learning environment: creation	
• effective use of the computer's capabilities in the creation of familiar, easy-to-understand, and engaging learning environments to facilitate and enhance the processes of teaching and learning new knowledge and experiences (Juliebö and Durnford, 2000, pp. 7, 8)	• to represent the concepts of beat/tempo, rhythm, and form through a linear and sequential animation of images and symbols that are well synchronized with the sound/music performed by the computer
Instructional situation: creation	
• projection of an instructional situation in which the teaching and learning activities, performed with the aid of the computer, are well integrated with other more-usual instructional activities (Coalition for Music Education in Canada et al; 2000, p. 9) • projection of an instructional situation in which the interaction between the teacher and the students, and the instructional message, allows the incorporation of group-play learning activities (Piaget, 1969, pp. 117-122)	• to represent the concepts of beat/tempo, rhythm, and form through a simple animation pattern that is used as a model of musical representation to guide play, movement, and reading and writing activities • to represent the concepts of beat/tempo, rhythm, and form through the visualization of playful, active, amusing child-like activities
Instructional message: meaning	
• representation of concepts through concrete models (Maier, 1978, pp. 56-57) • use of analogous symbols to represent concepts or ideas (Vygotsky, 1978, p. 115) • conception of an instructional message that helps students working under teacher guidance to achieve specific grade-2-level outcomes (Vygotsky, 1978, pp. 85-86)	• to represent the concepts of beat/tempo, rhythm, and form through the use of analogous symbols—images that resemble, to a certain degree, the visual appearances of objects—that are presented in concrete, simple, familiar, and real situations • to represent the concepts of beat/tempo, rhythm, and form with a clear, simple, well-organized, attractive, charming, and ingenious visual composition
Instructional message: configuration	
• establishment of a linear and spatial sequencing (from left to right, and from top to the bottom) of the visual elements to resemble the musical scores' configuration and way of reading • application of principles of perception to create an orderly, simple, clear, and coherent visual configuration (Carlson et al; 2000, pp. 208-209; Mayer, 2001, pp. 112-112, 114; Piaget, 1969, pp. 117-122) • use of visual resources to organize, differentiate, and associate information within the visual field or computer screen (Dondis, 1974)	• to represent the concepts of beat/tempo, rhythm, and form through a linear and sequential animation of analogous and arbitrary symbols • to present an orderly, simple, clear, and coherent visual composition of analogous and arbitrary symbols, that has been achieved through the application of the Gestalt principles • to present visual information through the use of the basic elements, that has been organized/related and differentiated through applying the techniques of harmony and contrast (see note [1] in p. 29).

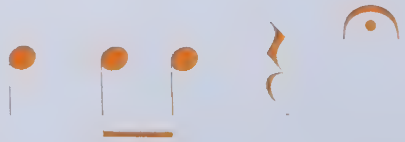
Visual system
Components



Chinese boy symbol

Beat bar

Background bands



Quarter note, eight notes, quarter rest and fermata symbol

Design evaluation:
exploration of the effectiveness of using the animated listening map for music instruction

The evaluation of the design proposal is comprised of two different studies conducted to assess the effectiveness of using the animated listening map for music instruction. Specifically, these assessments were aimed toward evaluating the potential of using the animated listening map to aid the teaching of particular musical concepts in the classroom and the reactions and attitudes of teachers and children toward it.

The first study consisted of individual semi-structured interviews conducted with four music teachers from elementary schools of Edmonton. The information obtained from these interviews concerned the following:

- the possible use of the instructional material in the classroom with grade 2 children
- the effective use of the instructional material for teaching specific musical concepts
- the possible learning activities performed through using the instructional material in the classroom
- suggested improvements with respect to the efficiency of the instructional material for teaching music
- the existence of similar instructional materials, specifically those based on computers, that have been developed for music instruction in elementary school
- additional comments

(see appendix B, p. 73)

The second study involved the use of the animated listening map to deliver a 30-minute music class at the Education Centre of the University of Alberta with a group of grade 3-4 students from the Child Study Center of the named institution. The information obtained from conducting and observing this music class was based on the following:

- the effective use of the instructional material with children in the classroom
- the effective use of the instructional material to teach specific musical concepts
- the attitudes and reactions of children to the use of the instructional material in the classroom
- the improvements of the instructional material to be carried out in order to propose specific guidelines for the design of similar tools for music instruction

(see appendix B, p. 106)

4.1 Information obtained from the assessments

Feedback from the music teachers

In order to present the information provided by the teachers without revealing their identities, they are named as teacher *a*, teacher *b*, teacher *c*, and teacher *d*. The information is organized according to the issues of the studies enunciated above (see appendix B, pp. 77-105).

Introduction to the interviews

At the beginning of the interviews, the experimenter presented a brief and general description of the design project (see appendix B, p. 76). It was followed by the presentation of the animated listening map on a computer screen. During and after the first presentation of the first and second versions of the material, the teachers seemed to be captivated with what they saw; this was reflected in some of their expressions:

> "Wow, it changes the colours for the beat sections; it's great! I like the rhythm…" *(teacher a)*
>
> "Oh, that is so excellent. That is very engaging…" *(teacher b)*
>
> "Cute, really nice…" *(teacher d)*

In addition, teacher *a* and teacher *d* highlighted the effectiveness of using a colour code for differentiating the notation symbols, and for distinguishing the musical themes when it was applied to the background bands. Overall, they perceived a good integration of the visuals that facilitated the understanding of music. Some of their comments reflected this:

> "It just helps to have that little person jumping around too, showing the steady beats and the rhythm of the piece." *(teacher a)*
>
> "Excellent! Oh, I love the rhythm underneath like that, how his arms actually match, oh I just, it's great, it's fabulous" *(teacher b)*

Content of the interviews

POSSIBILITY OF USING THE ANIMATED LISTENING MAP IN THE CLASSROOM WITH GRADE 2 STUDENTS

All the teachers agreed on the possibility of using the animated listening map for music instruction with grade 2 students. Teacher *c* highlighted the effectiveness of having a visual thing to guide listening; she expressed that students "…relate really well to something visual, always."

On the other hand, teacher *a* mentioned that she would use this map, specifically that showing the notation, in grade 2 since the students in grade 1 have already been introduced to these rhythmic values through

singing, moving, and using body percussion in response to short and simple rhythms. Hence, she stated "that's building on what they already know but getting more into the music reading." In addition, teacher *c* said that the notation represented was perfectly read at that age level. Teacher *b* and *c* also saw that using the two versions of the animated listening map in the sequence presented could be part of an effective instructional strategy. It would consist of having the students first try to understand the rhythm that they perceived to then correct or reinforce their answers by showing the map with the notation.

USE OF THE INSTRUCTIONAL MATERIAL TO TEACH SPECIFIC MUSICAL CONCEPTS

When asking the teachers about which musical concepts they could teach with the listening map, all of them responded that those concepts would be *beat, rhythm* with the notation, and *form*. Teacher *b* mentioned that she could also teach *phrase* based on the spatial arrangement of beat bars on the screen, that were organized into lines of 8 units. Moreover, teacher *c* expressed the following: "I think it can be extended; there are many possibilities, and you can probably adjust it to what level of children you are at… " On the other hand, teachers *a, c,* and *d* mentioned that the animation was not representing the *melody* of the musical piece. Teacher *d* also suggested that, "maybe in another thing you can demonstrate a lot of contours… that's a very visual thing…'

In addition, they highlighted the representation of the majority of concepts in one listening map. Teacher *c* commented that, "…visually it tells them a lot of things…" Teacher *a* also perceived the linear sequencing determined for presenting the information on the map by expressing that, "you are using the visuals to follow along to have them read from left to right as they follow the character across…"

LEARNING ACTIVITIES PERFORMED THROUGH USING THE INSTRUCTIONAL MATERIAL

Teacher *d* suggested some activities that she could perform before, during, and after introducing the animated listening map to the class. The introductory activities would consist of telling a story about the Chinese dance followed by a brief discussion with the students about its theme, and by the playing of the music to have the students step the beat. While seeing the animated listening map, the students would follow the rhythm by tapping their laps. In addition, the students could move by imitating the Chinese boy dance depicted across the screen. After seeing the animated

listening map, students would create their own listening map on a sheet of paper. Teacher *c* also mentioned some movement activities such the creation of a little dance that the students could perform while following the animated listening map. Teacher *a, b,* and *c* mentioned that they could do some activities with non-pitched instruments after listening to the animated listening map several times. These would consist of performing the rhythm of the musical piece with some percussion instruments. Teacher *c* commented that by doing this activity, she could make the students determine the *tone colour,* the quality or character of the sound played by an instrument, that went better with the music.

In addition, teacher *a* proposed to have a version of the animated listening map in a sheet of paper, so that after listening to the music many times, she could ask the students to write the rhythm underneath the beat bars.

EFFICACY OF THE MATERIAL FOR MUSIC INSTRUCTION AT GRADE 2 LEVEL, AND SUGGESTION OF POSSIBLE IMPROVEMENTS

In order to determine the efficacy of the animated listening map, teacher *a* commented that she would use it as a tool for reinforcing learning outcomes since grade 2 level students already knew what was represented on the map. She expressed this as, "ok, here is this little figure and this is the piece: tell me what the form is … because they are building on past experiences, and by then they know what A-B, A-1 is and all those kinds of things…"

Teacher *b* commented about the effectiveness of having a listening map animated; she expressed that, "it will definitely help a lot of students that would have problems keeping the steady beat tufted to that visual… and because he is moving along with the beat I don't have to say anything. I don't have to show them…" Teacher *b* also saw the advantage of having a map animated when talking about special need students; she stated that, "for students with special needs, who maybe can't grasp those concepts at this level, they would certainly be able with this little dancer going over the top…" Teacher *c* did not see any impediment for having a material based on computers given the familiarity of children with computers as a result of using them either at home or at the school. She also said that, "definitely the movement is something that the kids would like… the majority of kids out there are TV bugs or computer bugs… they don't want anything too dry; it has to be exciting for them…" Teacher *a* agreed with this and added: "…and kids are so inundated now with video games and television,

and they want to be entertained… and we are trying to definitely develop creativity and other skills because they spend so much time viewing…"

On the other hand, teacher *c* stated that in order to motivate the students, the teacher would do computer-based activities in combination with other more traditional ones; she expressed this as "because the kids work with computers at home and at the school… you wouldn't use it all the time… the next time they're listening something you do something different and then come back to something similar to it at another time…"

Existence of similar instructional materials based on computers for music instruction

All the teachers mentioned that they had not seen any listening map animated like the one presented. They mentioned that they used listening maps that were printed on paper so that they had to point at the images to show the students where the music went. Teacher *c* mentioned a mini program that came with the series "Share the Music" developed by McGraw-Hill that had computer-based activities to do with certain lessons at all grade levels.

Additional comments

Teacher *a* and *c* mentioned the difficulty of having the technology set up and available to be able to demonstrate the listening map. Teacher *a* expressed that, "so as long as it is CD ROM then you can demonstrate that way, but we pretty much have to be in the lab to be able to do that, so it just takes a little of creativity and figuring out how to do all that kind of things." Teacher *c* also stated that "but if the availability of the technology works out, something like that would be excellent… You know, as long as each child could be at a computer." Other comments added at the end of the interviews were the following:

> "I think it looks very valuable; I think it's something that I would use… I can see using this with special needs students, D1, and D2, ...good job!" *(teacher a)*
>
> "I'm very impressed… I can't wait to have my hands on that." *(teacher b)*
>
> "I think it would be fun, I think that the kids will really enjoy it, they will enjoy it, not realizing they're learning a lot…" *(teacher c)*
>
> "It's very easy to follow… so you can write down that I said: yes, it definitely would be useful for the teachers in animated listening maps" *(teacher d)*

Analysis

Overall, this assessment defined the material as an original and effective computer-based aid to teach music to grade 2 students. Specifically, it highlighted some qualifications with respect to the creation of the instructional message and the use of it in the classroom. In addition, this review was completed with some suggestions concerning the use of the animated listening map for music instruction.

With respect to the creation of the instructional material, the design strategy was considered effective as a result of the following:

- it created a representation of concepts that facilitate the instruction of musical understanding and engage children in the process
- it created an attractive, amusing, child-like, as well as clear, simple, united, and organized representation of music
- it created a rich representation of musical concepts
- it used colour effectively for representing musical information
- it introduced students to the sequential reading of musical scores

With respect to the use of the animated listening map, this was described as follows:

- suitable use of the material for teaching musical concepts to grade 2 students, which are the concepts of beat and rhythm with the notation and form
- suitable use of the material with grade 1, grade 2 students, and special needs students
- suitable use of the material in learning environments based on cognitive learning-theories. With respect to this, the animated listening map is considered to be effective when using it to reinforce musical understanding already achieved by adding more complex musical concepts and skills such as reading and writing the notation represented on the map
- effective use of the material as a result of allowing the teacher to 'complete' the instructional message through creating various types of activities with the animated listening map. In addition to the listening activities, these are the movement, playing, improvising/composing, writing, and drawing activities
- effective use of the material as a result of having two versions of it, which allowed the teachers to demonstrate the musical concepts first

and, after that, test the achievement of the students regarding the concepts already taught

The suggestions resulted from this assessment were the following:

- the creation of similar design solutions for the representation of other musical concepts such as melody
- the sparing use of the animated listening map for the instruction of music, in combination with other more traditional activities to avoid overwhelming the student motivation and attention toward the instruction
- the availability of the material in a CD ROM in order to demonstrate the animated listening map either at the computer lab or at the music room by previously having and setting up the appropriate technology

A music class delivered to children

The material was used in a testing situation to determine its effectiveness with grade 3-4 level children who had already learned the musical concepts represented by the animated listening map, that is, they came to the class with the prerequisite knowledge and experiences that will help them understand the map's content. In order to demonstrate the material, the computer containing the animation file was connected to a projector so that the images were displayed on a big screen. In addition, the computer was plugged into large speakers.

Below is a description of the music class followed by a brief review of what was observed and taped during the class.

Music class

Prior to the class, the teacher wrote on two different whiteboards three different rhythms introduced by 8 rhythmic units or beats without rhythm in the first board and a longer rhythm in the second board. The first board presented three distinctive rhythmic phrases that were identified with three different colours: blue, black and red. Each of the rhythms comprised 16 beats, they were represented with the quarter note, the eight note, and the quarter rest values above short segments representing the beat bars. The second board presented a rhythm phrase of 24 beats that was written with the notation already mentioned.

The rhythm represented by the animated listening map consisted of an introduction of 8 beats, a rhythmic phrase of 16 beats that was repeated

6 times, and an ending rhythmic phrase of 24 beats. The introduction of beats and the rhythm of 16 beats corresponded to the introduction of 8 beats and the rhythm (represented by the colour blue) that were written on the first board. The ending rhythm of 24 beats in the listening map corresponded to the rhythm represented in the second board.

INTRODUCTION OF THE CLASS (see appendix B, pp. 109-110)

At the beginning, the teacher had a brief conversation with the children through which he shared with them his experiences from the last two months—the time spent since he had seen them. Then, he introduced me to the class as a graduate student from Art and Design who was developing visual things on computers. He then said to them that, "…and you are going to see something today, if you earn it…(the children laugh at his comment)." Then, by making sure that the children were able to see the boards, the teacher showed them the different rhythms. First, he pointed out the line of 8 beat bars saying that it corresponded to an introduction. Through a brief discussion with the teacher, the children responded that they were seeing and hearing 8 beats of 'nothing' in that introduction. Continuing with this, he asked them to follow it and speak the different rhythms with the syllables 'ta,' corresponding to the quarter note, and 'ti,' corresponding to the eighth note, and to say nothing for the quarter rest. While they were doing this, the teacher showed the beat by pointing at the beat bars on the board with a rhythm stick. Secondly, he made them look at the second board where, as he said, "…there is the ending of what we are going to see after," and asked them to say that rhythm. In it, there was one element that he reminded the children about: it was a symbol called "fermata" that was written above the last note to indicate that the sound represented should be performed as longer to highlight the end of this rhythmic phrase. At the end, the teacher congratulated the children since they had read all the rhythms perfectly.

FIRST PRESENTATION OF THE ANIMATED LISTENING MAP

Before presenting the animated listening map, the teacher asked the children to identify the rhythm written on the board that corresponded to the rhythmic phrase repeated in the animation after the introduction. He also asked them to figure out the number of times that rhythm was repeated, and he also told them that he would indicate when the ending rhythmic phrase started in the animation. During the demonstration of the animation, while seeing the Chinese-boy symbol dancing across the screen

with the music, the children laughed when seeing each other faces. The teacher called for their attention when the music reached the ending part. After the children had seen the animation, they hesitated in identifying the correct rhythm so that the teacher asked them to choose one, saying: "…don't be shy, just pick one." Part of the class said that the rhythm of the music corresponded to the black, others said that the rhythm represented was the blue, and a few of them picked the red as the correct one. The teacher again had the children say the rhythms out loud while he marked the beat. During this activity the teacher asked the children some questions such as, "how could you tell that that rest was there?" To this, a child responded that, "…because he (the Chinese dancer) disappeared." He also asked them how they saw the introduction or the beats going; one of the answers was: "…because they (beat bars) turned red."

Second presentation

During the second presentation, some of the children softly sang the rhythm with ta's and ti's. After the music ended, all of them agreed that the rhythm of the music corresponded to the blue. The children watched again the animation to see how many times this rhythm was repeated. The teacher suggested to "put a finger down and count…" any time that they heard and saw the rhythm again. After that, they said correctly that, "it was repeated 6 times" before the ending.

Third and fourth presentations

Once the children knew the rhythm of the musical piece, the teacher showed them the animated listening map presenting the notation underneath the beat bars. Immediately after they heard and saw the map, the majority of the children figured out the relation between the different movements of the dancer and the ti's and ta's; a child said: "I know how he acts each one of the beats." All the children started to describe and demonstrate the different positions performed by the Chinese boy. One of them commented that, "and then nothing for the rest (value)." To continue with the class, the teacher had the children stand up in front of the board to see the blue rhythm and demonstrate the different positions for the different note values. After the children had performed this perfectly, at the request of the teacher, they followed the animation one more time by clapping the rhythm. When they finished with this activity the teacher expressed loudly the following: "wow! you are good! I thought on that quarter rest I was going to hear a whole bunch of claps and you know what

did I hear? (he heard 'nothing')... Wonderful!" In addition, the children replied in the affirmative when the teacher asked them whether the colour coding for the notation had helped them to read the rhythm.

Ending of the class

At the end of the class, the teacher told the children that the animated listening map represented a musical piece composed by Tchaikovsky that belonged to *The Nutcracker* suite. He asked them whether they remembered or knew the name of the piece trying to help them by saying that, "...if you look at the person dancing it may give you a clue...." A child responded that the piece represented was the *Ukrainian dance* while another said that it was the *Russian Dance.* When one of them said the title *Japanese* the teacher corrected him by telling to the class that the dance was called *Chinese dance,* and that was why the Chinese dancer wore that particular costume and moved across that particular scenery.

Comments of the teacher

Within a conversation at the end of the class with the children and with the teacher in charge of the group of children, the music teacher made the following comments:

> "So now, Mariana has seen that the teachers liked it, you (the children) liked it, I loved it..."
>
> "...visually is so easy to follow, you can see the rest goes by, and you can see the beats go by...and what I realized was that even when a listening map is static the teacher should make it animated by pointing and everything... but this does all for you...is right there...so that all listening maps can end up in CD ROMs...isn't that wonderful?"

Review of the class

The study conducted through observing a music class suggested that the animated listening map could be useful in a classroom to aid in the instruction of music to elementary school students. In this case, the material was used to test and reinforce the student knowledge and experiences corresponding to the musical concepts of *beat* and *rhythm.* The first time that the children saw and heard the animation they seemed to be captivated by the colours and images that were changing and moving on the screen. As a result, they were not able to concentrate on the identification of the particular rhythm represented in the animation. During the second presentation, they were able to identify and recognize

the rhythm of the musical piece without any difficulty. Moreover, they understood all the visuals perfectly; they recognized the change of colours of the beat bars as the representation of the beat, the different movements of the Chinese figure as the identification of the different rhythm units, and the sudden absence of this figure from the screen as a sign for the rest value. Overall, the teacher and the children were motivated and engaged in the different instructional activities performed with the aid of the animated listening map. Particularly, the teacher found the representation of the music very clear and easy to understand. He also highlighted the advantage of having a listening map animated which facilitated the instruction of music through a clear, concrete and attractive representation of abstract concepts. In addition, the children enjoyed themselves and were motivated throughout the class founding the animation funny, attractive and easy to understand.

4.2 Discussion of the two studies conducted

The two studies conducted suggested that the animated listening map can be used in the classroom for the teaching and learning of musical concepts, primarily through listening and responding activities. Specifically, the information obtained showed certain aspects of the animated listening map in terms of its effective support of music instruction. As well, the data collected showed that the animation of a listening map facilitated and enhanced instruction. As an example, one of the teachers highlighted the possibility of using the material with special needs students given the animated representation of musical concepts. In addition, during the second study, movement and singing activities were guided with the material being tested as a result of having an animated representation that could be followed in different ways.

On the other hand, the information used to explore the effectiveness of the design proposal was obtained from the small studies conducted that had their own limitations. The interviews carried out with the teachers were planned for having the teachers' first and general impressions of the novel material based on their professional experiences and knowledge. As a result, individual semi-structured interviews were effective for obtaining valuable feedback. However, more reliable and novel information can be obtained from having the teachers use the animated listening map in their classrooms to later make comments based on the experiences already had. With respect to the class delivered with the aid of the animated listening map, it provided information that supported and extended the data obtained from the first study for a more effective evaluation. Yet, more

detailed information can be collected through comparing results that, as an example, can be obtained from teaching to two groups of students through using a traditional listening map with one group and the animated listening map with another group. Later, valuable data can be collected through conducting student evaluations focusing on the learning experiences acquired from and the motivation toward the particular instructions.

The information obtained from conducting these small studies, which highlight the effectiveness and benefits of using the animated listening map for music instruction, is further used to suggest some guidelines for the design of effective computer-based instructional aids. These guidelines or premises are enunciated in the conclusion of this report.

Conclusion

Effective visual communication design, with the support of knowledge from other disciplines, can contribute significantly to the successful conception, planning, and development of communicative situations. It does so through the specific creation of means for the interpretation of specific visual messages.

In this thesis project, the design intervention, in the area of music education, was aimed at creating a suitable learning environment, instructional situation, and instructional message to support the teaching and learning of musical concepts primarily through listening and responding activities at the grade 2 level of elementary education. As a result of carrying out the proposal to meet the design objectives, and the design evaluation, some premises can be defined for the design of computer-based aids for the instruction of music at the first grade levels in elementary school.

Based on the design objectives, the design proposal consisted of an *animated listening map*—a simple, clear, and coherent, as well as attractive, playful, and ingenious animation of analogous and arbitrary symbols, in real and familiar situations, that represented the *beat/tempo* and *rhythm* with the notation and *form* of the *Chinese dance* musical piece. This proposal also depicted a linear sequencing of animated elements to resemble the configuration and reading sequencing of the musical scores. The animated visual composition was achieved through defining a visual language that was arranged and presented on the screen by applying the Gestalt principles of similarity and proximity, the principles of temporal contiguity and coherence for multimedia design, and the visual techniques of harmony and contrast.

As result of evaluating the design proposal in terms of its effectiveness for music instruction, the following conclusions were reached. Generally, the design strategy was effective in developing a prototype for an *animated listening map* that is suitable for aiding in the teaching and learning of the musical concepts of *beat* and *rhythm* with the notation and *form* to grade 1, grade 2, and special needs students. It appears to be suitable as a tool for testing and reinforcing the understanding of musical concepts achieved by more advanced students. This was demonstrated through assessing the material with a group of grade 3-4 students, with whom it was used to reinforce the understanding of the musical concepts of beat and rhythm with the notation. Specifically, the design strategy was effective in the following ways:

- *defining an instructional environment and message that facilitate instruction and engage students in the learning of musical concepts.* This was achieved through the animation of analogous and arbitrary symbols in concrete situations, and the use of a visual language to present organized and meaningful information in a linear and sequential fashion through applying particular visual principles and techniques. The students participating in the second study were able to understand the concrete representations of musical concepts such as the change of colours of the beat bars representing the beat of the musical piece. In addition, the teachers highlighted the creation of a simple and organized, as well as rich and united, representation of musical concepts that was clear and easy to understand.
- *determining an instructional message that facilitates the recognition, appreciation, and enjoyment of the musical piece.* The instructional message consisted of an animation of analogous symbols representing significant elements from the theme of the musical piece. The teacher in charge of the music class and the teachers interviewed explained that having something 'visual' to show helped them and the students talk about and remember the particular musical piece. In addition, both students and teachers enjoyed the experiences that they had with the demonstration of the animated listening map, finding it funny, attractive, charming, and easy to understand.
- *anticipating an instructional situation in which teachers actively 'complete' the instructional message presented in the animated listening map by creating group-play activities as well as other experiences.* The representation of a concrete, simple, playful, charming, and child-like situation depicted by the Chinese boy symbol dancing across the screen provides a visual aid that teachers can use to guide and create diverse musical activities. The teachers interviewed expressed the possibility of performing not only listening and responding activities, but also playing, improvising, composing, movement, and reading and writing activities by using the animated listening map in the classroom.

Based on the information obtained from the design evaluation, the following premises are suggested for the design of animated listening maps:

- create familiar, charming, child-like images presented in concrete situations for representing a musical concept to facilitate and engage students in the understanding, recognition, appreciation, and enjoyment of music through listening and responding activities.

- create clear, simple, unified, well-organized, coherent, and meaningful representations of musical concepts by using a visual language that is articulated to facilitate the teaching and learning of specific musical concepts through simultaneously listening and viewing.
- create a linear and sequential organization of elements to introduce and prepare students for the reading of musical scores.
- create a representation of playful and child-like activities to guide not only listening and responding but also a variety of other musical activities.

Concerning the experience gained from conceiving, developing, and evaluating an animated listening map, some recommendations can be made for future design interventions in the area of computer-aided education involving the development of research.

For the design of effective computer-based instructional aids, visual communication designers can work in collaboration with instructional designers, educators, administrators, parents, and students as well as with the support of knowledge from other disciplines that is specifically related to the design problem. Visual communication designers design and present the instructional messages on the computers to the learners that have been developed by the instructional designers. The instructional designers specify the instructional strategies—the particular ways of delivering the content to the learners that help them achieve the anticipated outcomes. They do so through the identification and definition of the instructional needs; the learners' characteristics, including their general characteristics, their previous knowledge and experiences related with the instruction, and their learning styles; the content to be taught; the instructional objectives, that is the specific student outcomes to be achieved; and the content sequencing. (Kemp, Morrison, and Ross, 1998) Later, within the development of the message, visual communication designers create an effective articulation of visual and verbal information for presenting the instructional strategies through the use of visual resources obtained from research carried out in the areas of visual communication and visual learning in computer environments. The design process ends with the evaluation of the design strategy after planning, producing, and using the instructional material.

Visual communication designers use tools or methods of evaluation to assess the effectiveness of the design strategy to further improve the material and to set guidelines for future interventions in the area. Their

evaluation outcomes can also be integrated with the information received from the instructional designers as a result of assessing the anticipated outcomes for an integral and effective evaluation of the instruction.

Based on this proposed design method in the area of education, further studies could address, for example, the conscious use of colour for the meaningful representation of musical concepts. In addition, a future study might consist of the design of interactive, animated listening maps, involving the definition of visual principles of interactive learning. From another perspective, it would be valuable to define the role of the teacher and the students in the delivery of the message. Concerning Vygotsky's notion (1978) that social interaction stimulates cognitive development (p. 90), one important aspect of this study would be to determine whether the use of interactive instructional aids is effective to facilitate collaborative learning. As well, if the instruction were received at home, the study could evaluate the benefits and limitations of studying outside a classroom environment to create an instructional aid that successfully support different modes of learning.

To summarize, visual communication designers promote and contribute to the well-being of members of society through the development of effective communication through the creation of objects and through stimulating research in several disciplines. This thesis project is not intended to be an end in itself. It aims to challenge design students and professionals to carry out research in related areas that will encourage the development of valuable and effective communication design.

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Appendices

Appendix A proposed animated listening map

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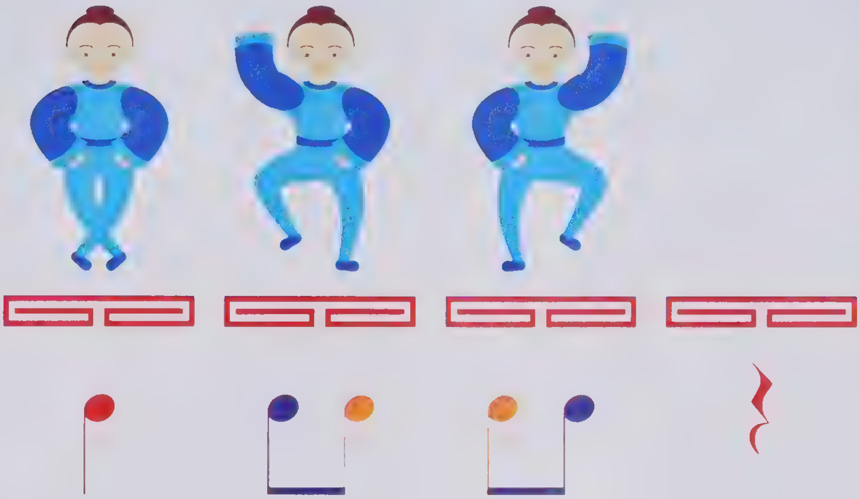
Appendix A:

proposed animated listening map

Presentation of the image in concrete situations

Chinese boy dancing across the screen

The concept of *rhythm* is represented by the Chinese boy symbol depicting an animated linear dance—from the left to the right side of the screen. The quarter note value is represented with the Chinese boy crossing his legs and placing his hands on his hips. The eighth note value is illustrated with the Chinese boy standing up on one of his legs and rising the arm from the same side of his lifted leg. The quarter-rest value is represented by the sudden absence of the Chinese boy symbol from the screen.

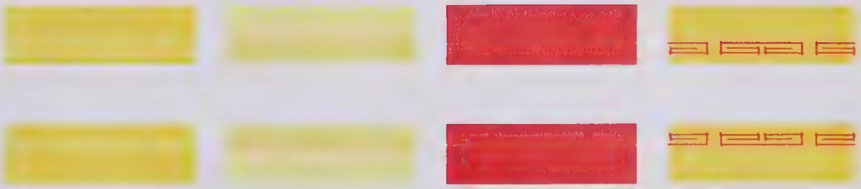


Linear arrangement of beat bars

The concept of *beat* is represented by successively highlighting with red each one of the orange beat bars, that are arranged according to a linear pattern.

Coloured background bands

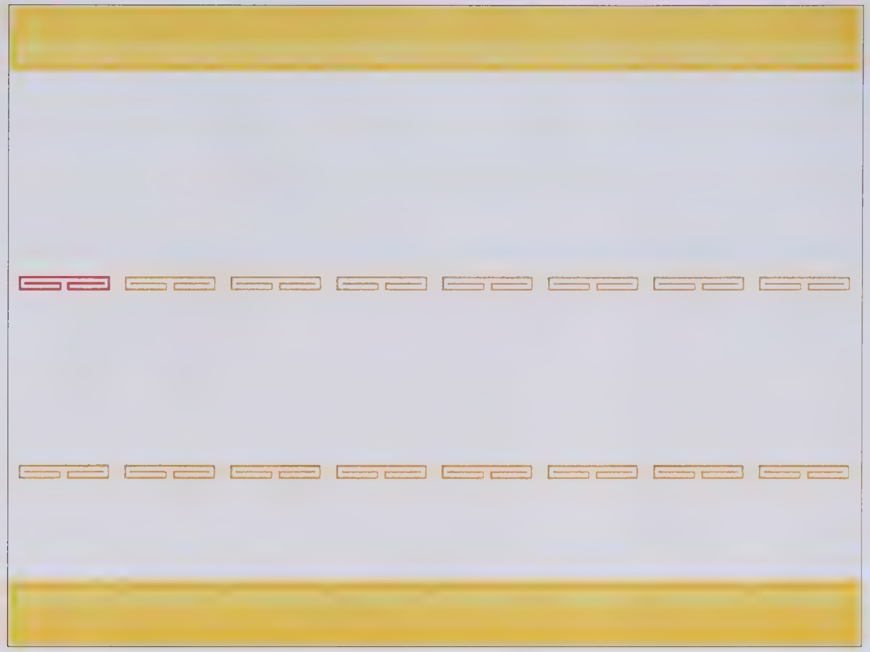
The concept of *form* is represented by the change of colours over time of the background bands responding to the particular melody pattern of the musical piece.



Configuration of the animated listening map: animation shots

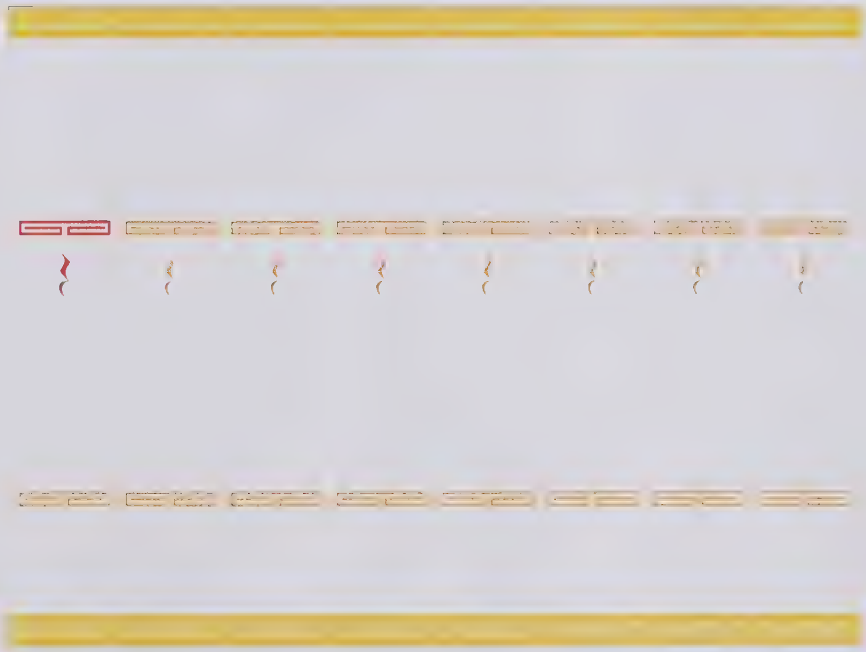
*Screen **intro** version 1*

In both versions, the screen *intro* corresponds to the first animation shot. It includes a linear succession of 8 beat bars that represent 8 beats of the musical piece through being highlighted with red.



*Screen **intro** version 2*

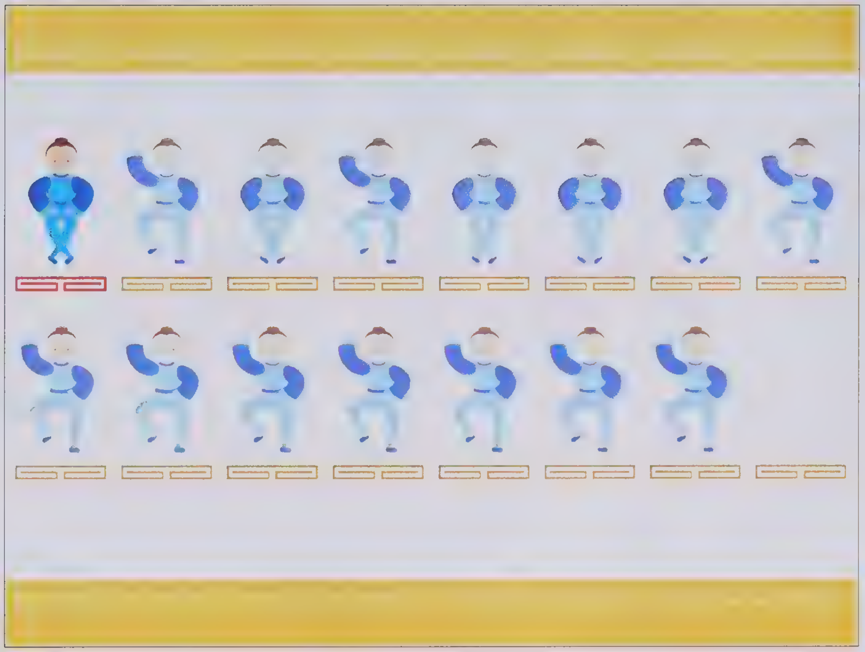
The *second version* of the animated listening map contains the notation, the representation of the musical piece's rhythm through the quarter note, eighth note and quarter rest values, and the fermata symbol.



In both versions, the screen *a* is repeated twice after the first animation shot. It represents the first musical pattern of the *Chinese Dance.*

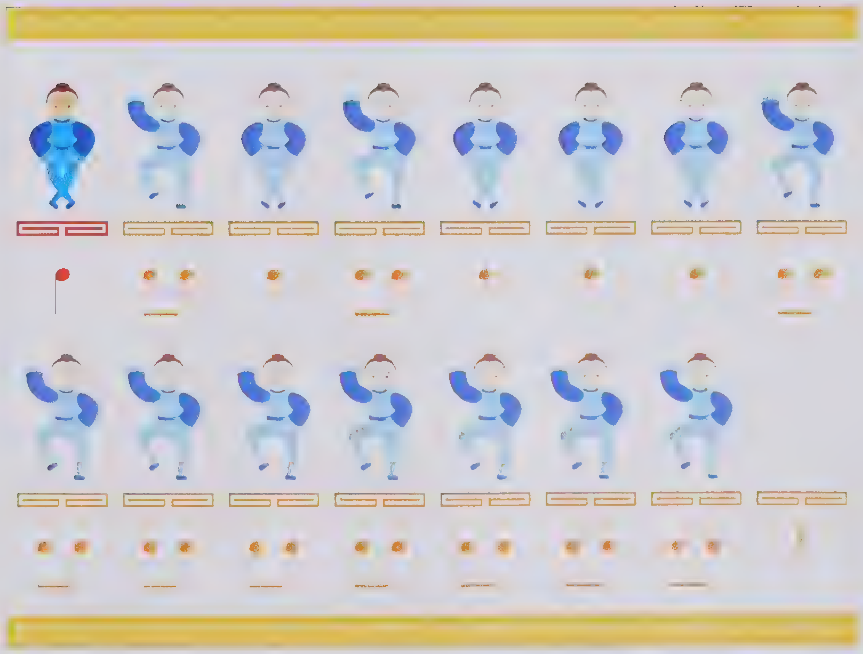
In these representations, the image of the Chinese boy standing up on his left leg with his right arm up illustrates the two images appearing successively in the animation above one beat bar to represent two eighth note values. These images are the Chinese boy standing up on his left leg with his right arm up and in the opposite position (see appendix A, p. 63).

*Screen **a** version 1*



The *second version* of the animated listening map contains the notation, the representation of the musical piece's rhythm through the quarter note, eighth note and quarter rest values, and the fermata symbol.

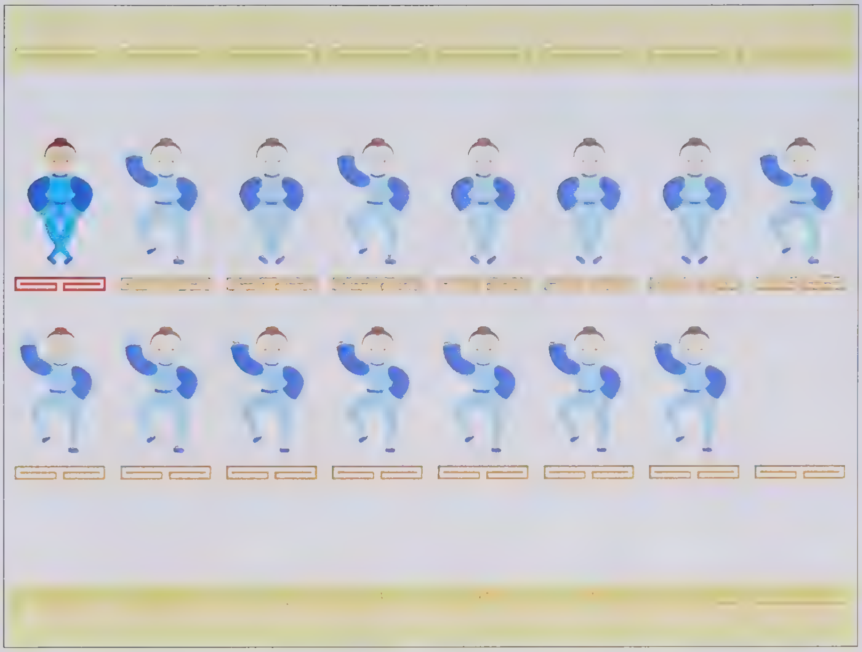
*Screen **a** version 2*



In both versions, the screen *b* is repeated twice after the repetition of the screen *a*. It represents the second musical pattern of the *Chinese Dance*.

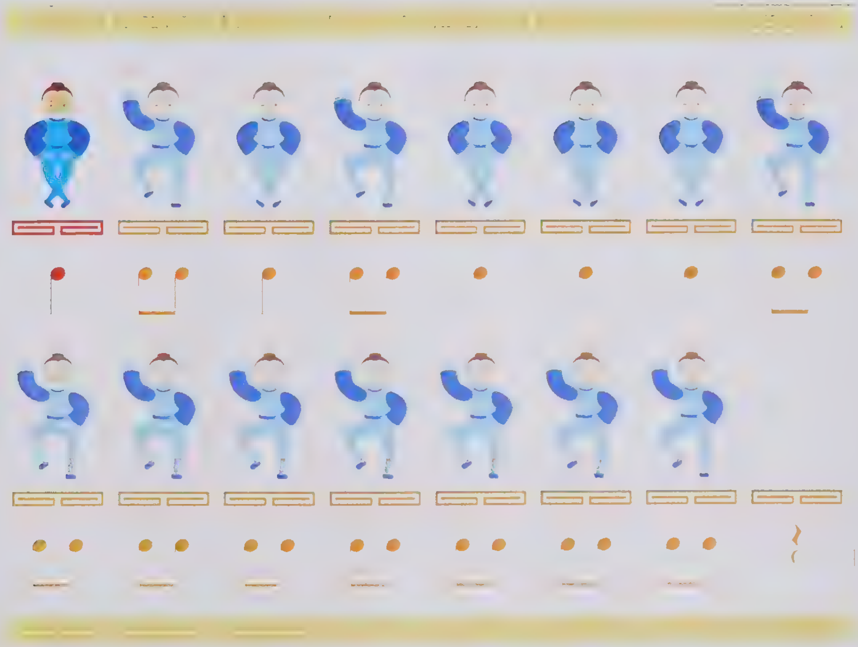
In these representations, the image of the Chinese boy standing up on his left leg with his right arm up illustrates the two images appearing successively in the animation above one beat bar to represent two eighth note values. These images are the Chinese boy standing up on his left leg with his right arm up and in the opposite position (see appendix A, p. 63).

*Screen **b** version 1*



The *second version* of the animated listening map contains the notation, the representation of the musical piece's rhythm through the quarter note, eighth note and quarter rest values, and the fermata symbol.

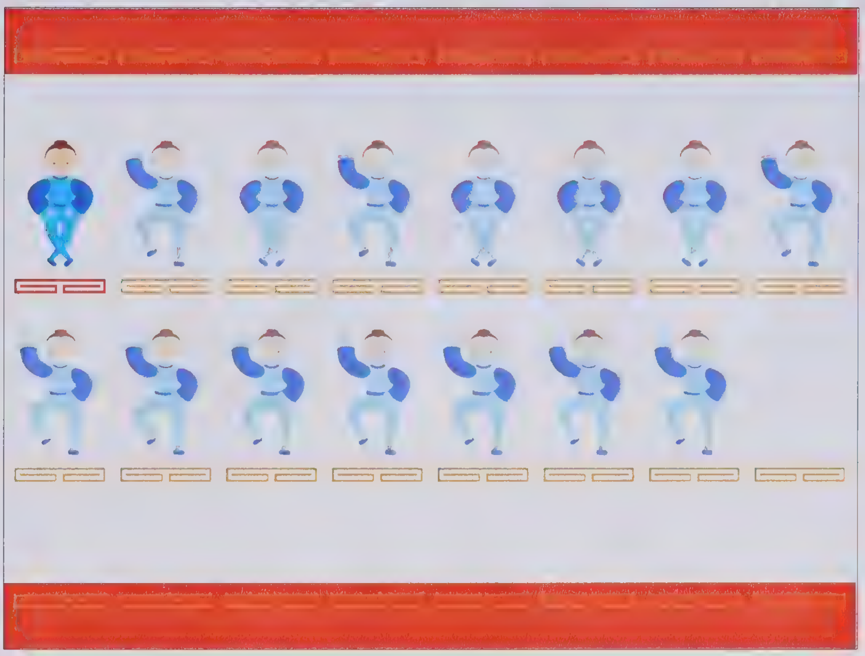
*Screen **b** version 2*



In both versions, the screen *c* comes after the repetition of the screen *b*. Screen *c* and *c.1* represent the third musical pattern of the *Chinese Dance*.

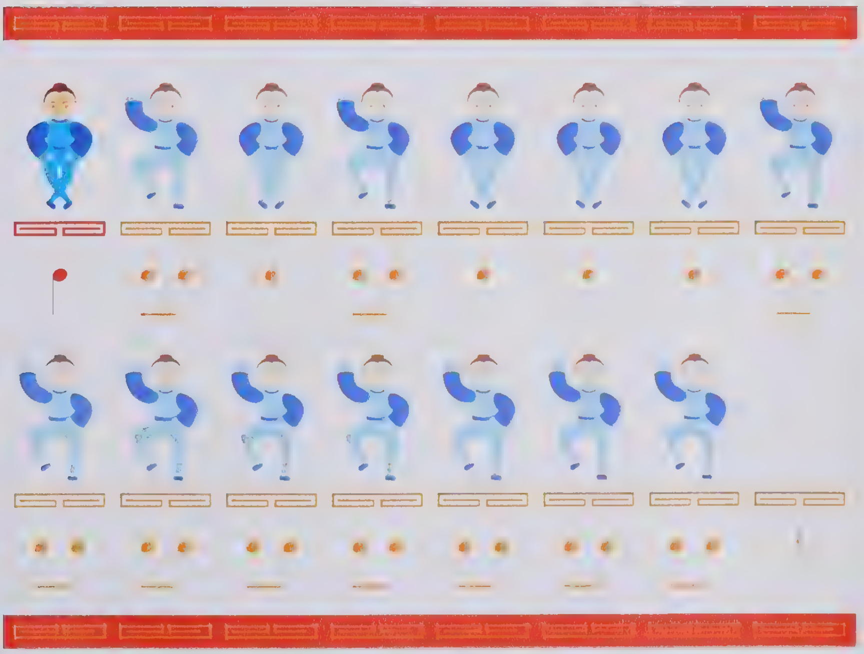
In these representations, the image of the Chinese boy standing up on his left leg with his right arm up illustrates the two images appearing successively in the animation above one beat bar to represent two eighth note values. These images are the Chinese boy standing up on his left leg with his right arm up and in the opposite position (see appendix A, p. 63).

Screen c version 1



The *second version* of the animated listening map contains the notation, the representation of the musical piece's rhythm through the quarter note, eighth note and quarter rest values, and the fermata symbol.

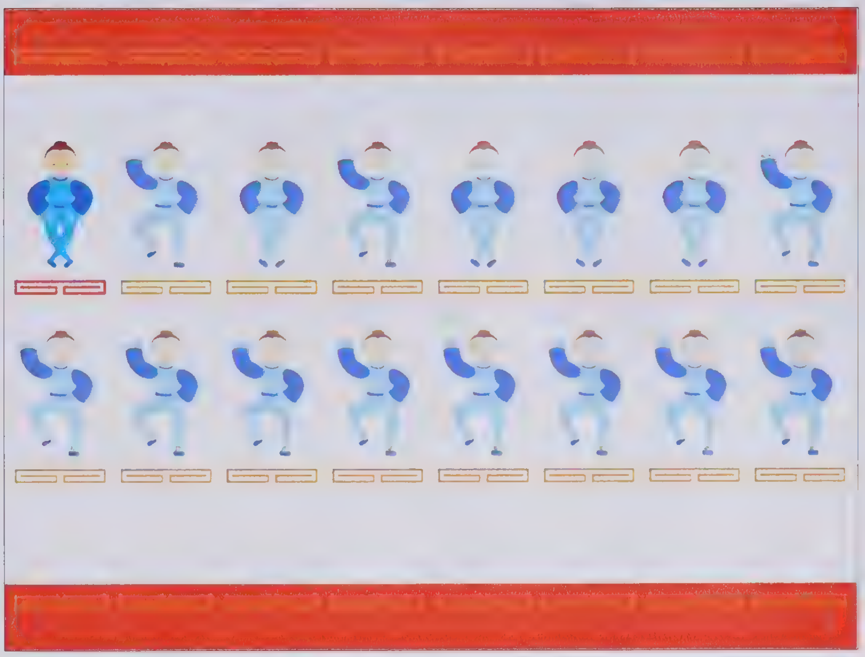
Screen c version 2



In both versions, the screen *c.1* follows the presentation of the screen *c.* Screen *c* and *c.1* represent the third musical pattern or ending part of the *Chinese Dance.*

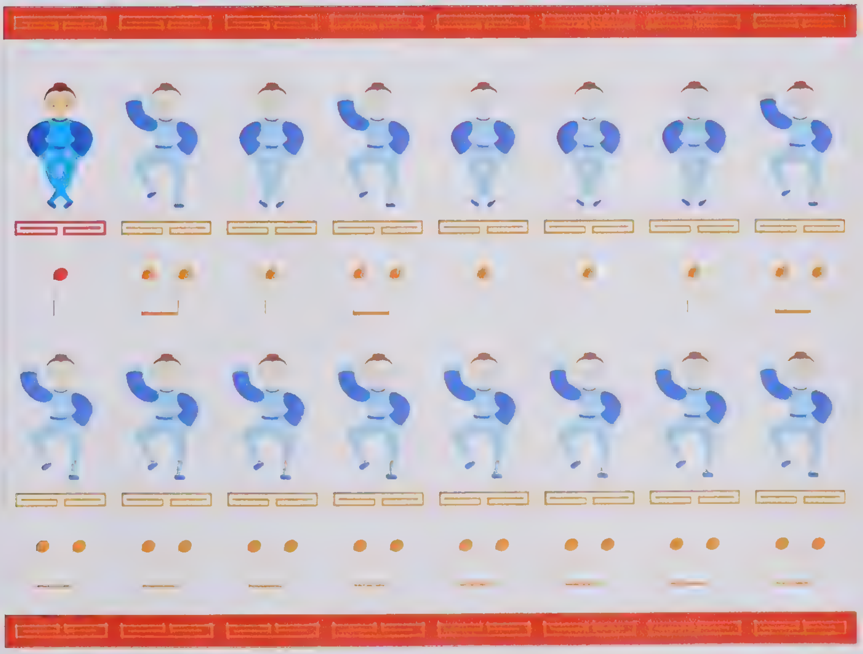
In these representations, the image of the Chinese boy standing up on his left leg with his right arm up illustrates the two images appearing successively in the animation above one beat bar to represent two eighth note values. These images are the Chinese boy standing up on his left leg with his right arm up and in the opposite position (see appendix A, p. 63).

Screen ***c.1*** *version 1*



The *second version* of the animated listening map contains the notation, the representation of the musical piece's rhythm through the quarter note, eighth note and quarter rest values, and the fermata symbol.

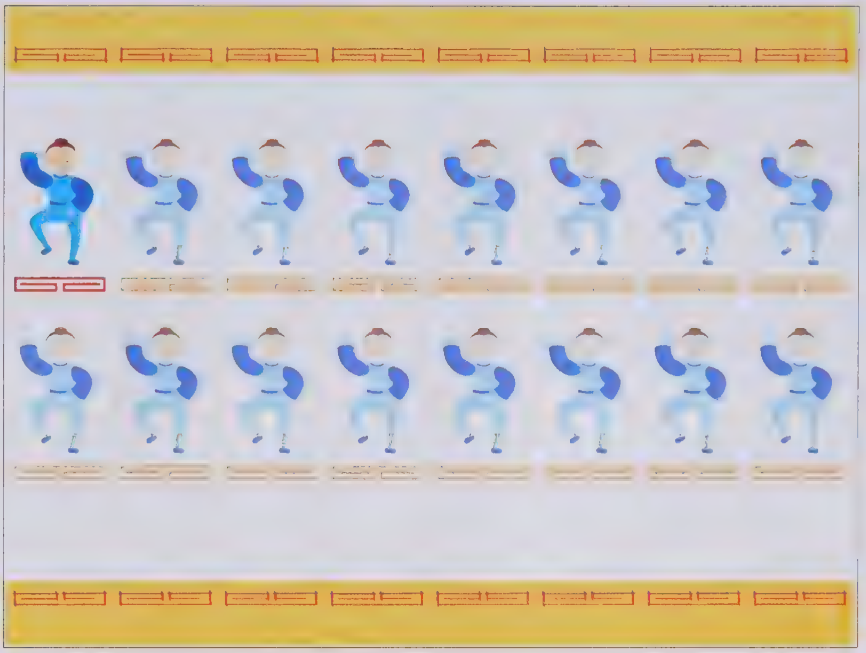
Screen ***c.1*** *version 2*



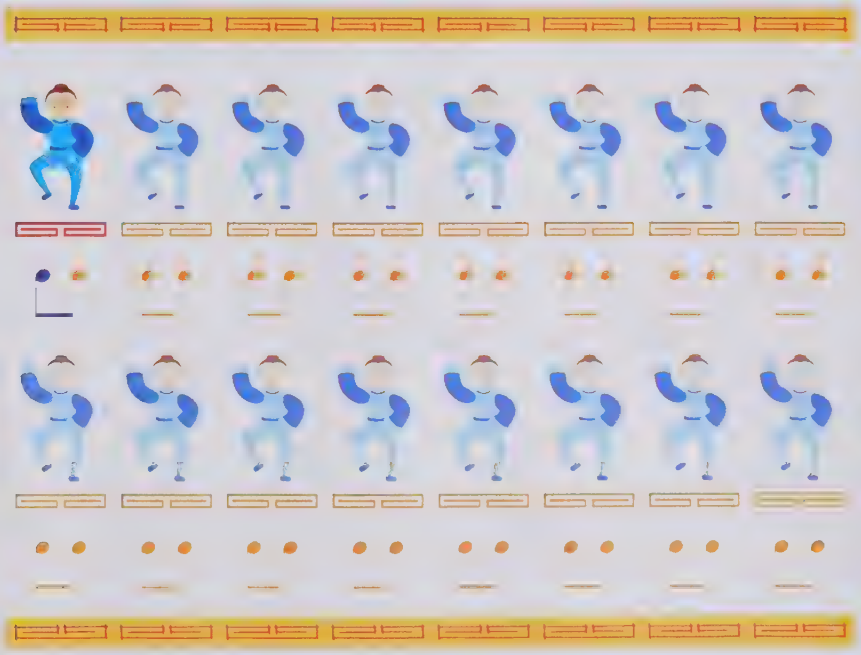
In both versions, the screen *d* follows the presentation of the screen *c.1.* Screen *d* and *e* represent the fourth musical pattern or ending part of the *Chinese Dance.*

In these representations, the image of the Chinese boy standing up on his left leg with his right arm up illustrates the two images appearing successively in the animation above one beat bar to represent two eighth note values. These images are the Chinese boy standing up on his left leg with his right arm up and in the opposite position (see appendix A, p. 63).

Screen **d** *version 1*



Screen **d** *version 2*

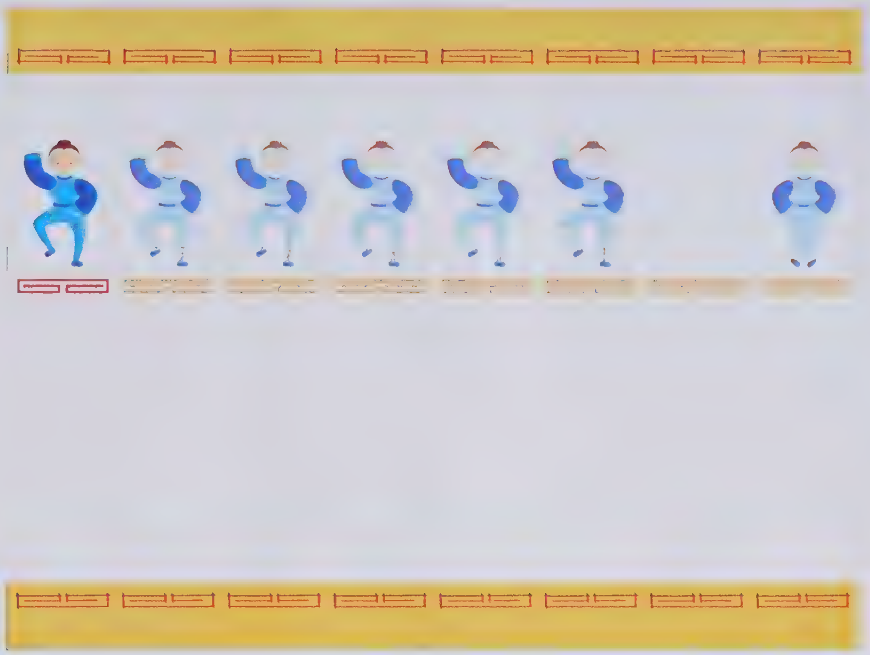


The *second version* of the animated listening map contains the notation, the representation of the musical piece's rhythm through the quarter note, eighth note and quarter rest values, and the fermata symbol.

In both versions, the screen *e* follows the presentation of the screen *d*. Screen *d* and *e* represent the fourth musical pattern of the *Chinese Dance*.

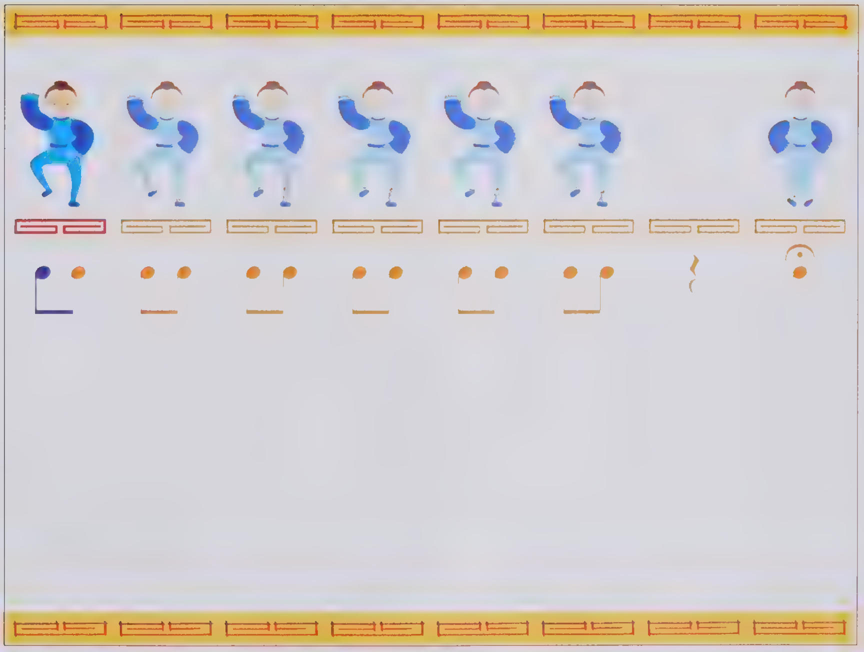
In these representations, the image of the Chinese boy standing up on his left leg with his right arm up illustrates the two images appearing successively in the animation above one beat bar to represent two eighth note values. These images are the Chinese boy standing up on his left leg with his right arm up and in the opposite position (see appendix A, p. 63).

Screen ***e*** *version 1*



The *second version* of the animated listening map contains the notation, the representation of the musical piece's rhythm through the quarter note, eighth note and quarter rest values, and the fermata symbol.

Screen ***e*** *version 2*



In both versions, the screen *final* corresponds to the last animation shot. It represents the final sound of the *Chinese Dance.*

Screen ***final*** *version 1*

The *second version* of the animated listening map contains the notation, the representation of the musical piece's rhythm through the quarter note, eighth note and quarter rest values, and the fermata symbol.

Screen ***final*** *version 2*

Appendix B:

evaluation of the proposed animated listening map

Study conducted with music teachers

Proposal for the study

The evaluation of the proposed animated listening map is part of the design thesis project. It comprises two small studies that are conducted to explore the effectiveness of using the material for music instruction. These studies are developed in partial fulfillment of the requirements of the Master of Design at the Department of Art and Design, University of Alberta. Specifically, the study conducted with music teachers is aimed toward knowing the teaching potential of using computer-based instructional materials in the classroom for teaching particular music content from the elementary school's curriculum.

The design thesis project consists of developing computer-based instructional aids to teach music literacy to children at the elementary school level. Particularly, the instructional material developed for the design thesis takes the form of an *animated listening map.* A conventional listening map is a type of instructional material that teachers use at grade 2 for introducing children to the understanding, recognition, and enjoyment of musical pieces by naturally associating familiar images with unfamiliar sounds. It is a spatial arrangement of images and iconic symbols that represents in a particular way the musical pattern described by a musical piece. An *animated listening map* is a spatial arrangement of images on the computer screen that change over time responding in a particular way to the musical pattern described by the musical piece being played on the computer.

With respect to the objectives of the study described above, individual semi-structured interviews will be carried out with four music teachers. Each teacher will observe the animated listening map and provide some professional feedback based on the following questions:

1) Do you think that this instructional material can be used in the classroom? Do you think that it can be used with grade 2 children?
2) Which musical concepts do you think that can be taught with this animated listening map?
3) Can you think about some learning activities that teachers can do with children by using this material?
4) Do you think that this animated listening map is an efficient teaching tool for music instruction? How do you think that this material can be improved?
5) Have you used anything similar to this listening map before or do you have any other materials in your classroom that you think might work similarly to this animated listening map?
6) Any other comments?

Consent form for music teachers

This consent form is provided to obtaining your consent for your participation on the study detailed below. This study is being developed in partial fulfillment of the requirements of the Master of Design at the Department of Art and Design, University of Alberta.

Design thesis project

The design thesis project consists of developing *computer-based aids* to teach music literacy to children at the elementary school level. Particularly, the instructional material developed for the design thesis project takes the form of an animated listening map. An *animated listening map* is a spatial and linear arrangement of images on the computer screen that change over time responding in a particular way to the musical pattern described by the musical piece being played by the computer.

Assessment of the material

The assessment of the animated listening map will consist of individual semi-structured interviews carried out with four music teachers. These interviews will be conducted at the elementary schools where the instructors perform their regular teaching activities. The interviews will be taped using a tape recorder with written notes as backup.

Objective of the study

The main objective of this assessment is outlined as follows:

- To obtain information concerning the effectiveness of the material for music instruction. Specifically, this assessment aims to knowing the teaching potential of using computer-based material in the classroom for teaching particular music content from the elementary school's curriculum.

Participation in this study

Should you agree to participate, the following conditions will be met:

- any information obtained from this assessment will be used anonymously and will remain completely confidential with the aim of responding to the design thesis project.
- comments from the interviews will be collected by using a tape recorder with written notes as backup.
- your participation in this study is voluntary and you can withdraw at any time without having to ask any further question.

Are you willing to participate in this study?

Yes ☐ No ☐

I agree to the terms:

Participant ______________________ Date ____________________

Thank you very much for your time. I would be very pleased to provide additional information concerning this assessment. The written report will be made available to anyone who is interested in knowing about this research.

Experimenter
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Script for the interviews

The following is the brief presentation of the design thesis project given to the music teachers at the beginning of the individual semi-structured interviews conducted with them, before demonstrating the animated listening map and asking them some questions (see appendix B, p. 73).

Presentation and introduction to the interviews

Experimenter:

> Thank you very much for accepting to participate in this study.
>
> My name is Mariana Waisman. I am a graduate student in the Master of Design Program at the Department of Art and Design, University of Alberta. I am currently in my second year developing a thesis project, which is part of the Master of Design's requirements. My thesis project consists of developing computer-based instructional aids for music instruction at the elementary school level. Particularly, my project involves the creation of a proposed animated listening map.
>
> Without giving to you more details, I would like to show to you the material that I have created to have your feedback about it. After you see it, as many times as you want, I would like to ask you some questions that I have prepared for this meeting. Please, at any time, if you don't understand something, do not hesitate to ask questions. As well, I would really appreciate if you would like to add any kind comments that you think might be relevant to this study.

Transcripts of the interviews

Interview a

Music teacher *a:* t.a
Experimenter: e

After a brief description of the instructional material being tested, it is demonstrated to the teacher. During the demonstration, the teacher makes the following comments:

t.a wow, it changes the colours for the beat sections, it's great! I like the rhythm, variation, it's good

e I would like to show you another version of the same listening map

t.a ok

While demonstrating the second version of the instructional material, the teacher expresses the following:

t.a oh, it's clever

After seeing both versions of the instructional material, the teacher makes her own comments and responds to the questions as follows:

t.a that is good. The colour coding and the eighth notes as opposed to the quarter notes is really effective, because you notice something right away and, you know, the changing backgrounds when it changes its themes is really good. It just helps to have that little person jumping around too showing the steady beats and the rhythm of the piece… I like that.

e do you think that this can be used in the classroom?

t.a hmm (affirmation)

e with children?

t.a oh, I think so. I really do think so, because I know I introduce this piece, *Chinese Dance* is introduced in grade 1, and we do all kind of little rhythm things while they are listening to it. And they actually

move around to the different rhythms, and that kind of things, and we show the differences in highs and lows. That's the only thing that you don't see here; it's where the melody is going, but in terms of the rhythm and the form of the piece, no, this is, this is excellent. I would probably do this at grade 2 where you're showing the actual notation, but you know, that's building in what they already know but getting into more the music reading. No, I have something that I would use.

e and which musical concepts do you think that can be taught with this animated listening map?

t.a oh, I can do *form* because you have your A and your B sections; you can do definitely the *rhythm*, you have your *ta's* and *ti-ti's* and *rest* which is basically what we're trying to get them to read at that age level. And the rest is the *steady beat element* in there as well that you can incorporate, and then … no so much *melody*… do you hear the melody?

e yes

t.a you can add in some movements and things, I think, to go that will accompany well, that will work out well. So, you're really incorporating everything I think. You are using the visuals to follow along to have them to read from left to right as they follow the character across. Oh dear, there are so many things, I can't think off the top of my head.

e do you think that it is a little complex for children to follow this map?

t.a I don't think so, because I taught this piece and I know how the students react to the music, and because we do a lot of the movements and activities in grade 1. I think if you went to grade 2 where you are adding to something that they already know, you're building on past experiences, then they will understand this and they are expected to build and to read those rhythms at that age. So, I think that it reinforces rhythm reading and all of those things I've been looking on. So, I don't think it would be too hard.

e and can you think about some learning activities that teachers can do with children by using this listening map?

t.a if you could have, if there were something where the children maybe had a page of their own, where they could watch this, but then after… follow (it) alone. Maybe you have these little symbols that are the same as on the screen for them to follow alone. Then after they've done that a few lessons, then I will have them write the rhythms underneath, that which corresponds to the piece. I think that would be very valuable.

e and while you are showing this to the children can they participate in some way?

t.a hmm, hmm (affirmation)

e following the map with the music…

t.a definitely, and then once they've written all of those things or they have listened to it several times, it's always a building thing, they could even use it in simple little instruments, for rhythm instruments, to accompany the different rhythms that they are hearing as well. So, yeah, I can see a lot of take off's with this.

e do you think that this animated listening map could be an efficient tool for music instruction?

t.a ah, you can always adapt and bump up the level of what your expectations are. So, for division 2, I would expect them to be able to read, to do the notation on their own. Ok, "here is this little figure and this is the piece: tell me what the form is," and of course they have some visual clues, but I think having them put that into some form, because again they are building on past experiences and by then they know what A-B, A-1 is and all those kinds of things. So, they can start putting some structure to that and develop the diverse skills. And you can almost do it as a testing situation to see if they have in fact got all of that. So, if they have to write rhythms themselves, maybe they wouldn't get this level where they see it (talking about the second version of the animated listening map where the rhythm is represented with the notation); this could be a reinforcement after they see if they got that correct. Definitely, it would be the writing activity, so you are taking the reading to the writing of those things.

e how do you think that this material can be improved?

t.a mmm, I don't know how what you would do, because it is very, very basic, and if you are going to take this to division 2 and do more complex rhythms you have to change the piece, right? Because this is for this piece, and… you can't change the rhythm because that's Tchaikovsky (laughing). But, no, I'd hand if I can, if I think in anything else, I would let you know. No, but I think that this has a lot of scope through.

e you talked about the melody…

t.a oh yes, that might be something. I don't know how you would do that, maybe some way of the spanning, maybe to a different screen, and they would take them somehow with the contrast and the melody, the ups and the downs, where it stays the same and that kind of things. And there are so many different things going on, you see that cello going, toom, toom, toom, toom, toom, toom, and then being able to hear all of those. So, for division 2 students, I have them listen to just one section first and then what is happening to the instruments beneath the instruments above, these kinds of things. So, I think you could develop it further with that, having some of the visuals showing, that would be good.

e have you seen anything similar to this animated listening map before?

t.a I haven't. If there is one out there I don't know; I don't certainly don't know of it, and I think it's a great idea, because we use listening maps all the time in music and there're just so powerful, and kids are so inundated now with video games and television and they want to be entertained, that they almost create that kind of situations, and we are trying to definitely develop creativity and other skills because they spend so much time viewing, but there certainly would be a hook to give them… and for students with special needs who maybe can't grasp those concepts at this level certainly can with this little dancer going over the top, I think, and actually most of my students, special needs students, can read these rhythms now, and they like to do that kind of things.

e any other comments?

t.a mmm, no, I think it looks very valuable; I think it's something that I would use. The problem we have is having the technology available in the classroom. Most of us here have a computer on our desk. My computer is PC and I have Mac at home (laughing), so, it's having compatible. We (at the school's library) do have a lot of screens and TV hooked to Machintosh, so as long as it is CD ROM, then you can demonstrate that way, but we pretty much have to be in the lab to be able to do that. So, it just takes a little of creativity and figuring out how to do all that kind of things.

e so, I think that you also need the space so that the children can move and do the activities

t.a exactly, so that is why it gets more valuable the music room where you have that space created and they expect to do those things there… So, that's the only stumbling block is having the tools or the technology to be able to carry out. But, no, I think that's an excellent program; it's a great idea and good concept, and definitely works well. You know, I can see using this with special needs students, D1, and D2, so… good job!

e Thank you, thank you very much for your feedback.

Interview b
Music teacher *b:* t.b
Experimenter: e

Followed by a brief description of the instructional material, it is showed to the teacher. After seeing the instructional material the teacher makes the following comments:

t.b oh, that is so excellent. That is very engaging.

e I can show you another version of the same listening map

t.b sure, ok.

After demonstrating both versions of the instructional material, the teacher makes some comments and responds to the questions as follows:

t.b excellent! Oh, I love the rhythm underneath like that, how his arms actually match, oh I just, it's great, it's fabulous.

e so, you think that this can be used in the classroom?

t.b oh yes, I will definitely, oh yes, absolutely. That's beautiful; it's so engaging. The kids will just, oh they will love that, and it helps them to track the beat and shows them the rhythm, his arms follow, and actually I would use both versions because then that way, you can have the students try to determine to underline the base rhythm.
Oh, that's perfect!

e so, will you show this first? (second version of the listening map showing the notation)

t.b I will show the first one first. The first one that you showed me without the rhythm underlined, and maybe, I can get my students to try in and determine the rhythm themselves. Oh, that is brilliant! I just love it, it's so engaging, it's beautiful. And how you had the colour change when the red came up as more layers of the music, as it got more complex, that was a really good idea too. That is fantastic, I love it!

e so, do you think that children can do some activity while you are showing this listening map?

t.b well, when they are watching the beat-bean track, I think, that will definitely help a lot of students that would maybe be having problems keeping the steady beat tufted to that visual to help them, and because he is moving along with the beat, I don't have to say anything. I don't have to show them; I don't have to do that because the little icon there is doing all that work for them. I will definitely use this in the classroom; it's wonderful. And it makes so clear for them because as they're trying to figure out the rhythm, then, it's showing up, and the blue as it changes from the yellow to the blue is showing exactly which part of the beat is being played, or which part of the rhythm is being played (the teacher observes the screen and counts the number of beat bars). And it's going to the phrase too, because you had it divided eight beats into eight beats, so, it's showing the phrase as well, yeah. So, you're covering a lot of concepts in one listening map. You are covering *beat,* you are covering *rhythm,* you are covering *phrase* you're covering... This (pointing to the beat bars on the screen) is showing the base underneath that underline rhythm structure, but he is also showing the more structure on top, yeah, you're covering a lot of different concepts all in one map. It's wonderful!

e and have you seen or used anything similar to this listening map before?

t.b well, I have used listening maps not animated ones like this though, no, so, I will have to track the beat myself, and this is wonderful because has the kids so engaged, oh absolutely. And it would be great for movement as well, because he is kind of suggesting some different movements. So, the children can use them then and they have a base to work from, if they want to make up like a little dance or do some kind of movement activity, yeah, that is a really good suggestion for them, great!

e thank you

t.b yeah, you can do rhythmic notation with them, beat keeping with them, so you are doing your music reading as well you can tie that into the movement activities and do some other things. And this can

be great because I make them pull out some rhythm instruments and follow along and actually do the long sample at the same time

e so, do you think that they can play the instruments without the music or with the music?

t.b oh, I think so (with the music), because if they… specially if they've already seen the music that you've already discussed as a class, you can go back to the original listening map, yeah. Excellent, you did a great job!

e thank you

t.b yeah, yeah…I'm very impressed. When can I buy it? (laughing)

e thank you very much for your time and feedback.

t.b you're very welcome. It's just excellent. So are you going to be making a few more of these as well do you think?

e now, I am doing this for my thesis…

t.b great, so this is the main project…

e yes, the main project. The idea is to see if something like that could be developed for music instruction, so your feedback is very valuable for me because you are the person that is going to use this material.

t.b there would be one thing that I would like to suggest, that I would like to see…

e yes, of course

t.b if you could perhaps start how you had the border in yellow, you started with yellow, and I believe… I have to one more listen to it. I think that maybe there could be three colours changing as opposed to two.

While seeing the animated listening map again, the teacher notes the following:

t.b oh, maybe it does it (change the colour).

After the demonstration of the animated listening map is finished, the interview continues as follows:

t.b I am wondering if that is just the part, just before the end of that, could be with a different colour. Because you have, ok, at the beginning you have it as the yellow, and then it comes in because there is another instrument added in, and then, when the third layer comes, it turns to red and then, there are different instruments that come in… I'm wondering if that could also be changed to show that form, the larger form.

e do you mean with a different colour?

t.b yes, a different colour after the red when the different… no, you see, can I listen one more time?

e sure

While showing the listening map again:

t.b ok, perfect (seeing the change from the colour yellow to the colour red) Oh, it did change back, the change is back to yellow.

After the musical piece is over, the interview ends as follows:

t.b yeah, no, it does perfect. Ok, because the change is back, perfect! Yeah, so, it is showing the *form* too, oh yeah, is great!

e thank you so much for your time and your feedback.

t.b you're welcome. My pleasure, that's wonderful, I can't wait to have my hands on that (laughing).

Interview c
Music teacher *c:* t.c
Experimenter: e

Followed by a brief description of the instructional material, it is presented to the teacher. After the demonstration, the interview continues as follows:

t.c (laughing)

e I have another version of the same listening map to show you

t.c ok

After seeing the second version of the animated listening map, the teacher responds to the questions as follows:

e do you think that this material can be used in the classroom?

t.c oh, definitely. Yeah, I think it can be used. My school, well, we have a computer lab so, as long as… I have to be able to take the whole class to do something like that… so, as long as it could be logged in all the computers then, perhaps, I can get into computer time. At my school right now, that's difficult for me to do that, because all the class are signed up, you know. But if the… (the availability of the technology) works out, something like that would be excellent. You know, as long as each child could be at a computer.

e And you think that this material can be used with grade 2 children?

t.c Yes, no problem. Notation is certainly something that they can read, and like the first one which is showing beat right? and the second one is showing the rhythmic notation… about the beginning is like a dotted note, tralalala ta ta ta, is where the dotted notes rather than the ti ti ta, but yeah hmm, hmm, yeah, definitely the kids, I think they relate really well to something visual, always. Like the people tend to be visual learners right? so, I can certainly see how you could put a sequence of something like that together, you know, if you are going to start with the beat, and I think it is excellent to have something that they can be looking at as they're listening, you know. The first one (without the notation) would be followed by the children while they

got the tune in their heads, and then, you can give them the rhythmic notation underneath. Yes, sequence wise, I think, is good. That's the way I would to it. Yeah, yeah, and they can see what's going on, and I would do things like "what are these things?" (pointing at the beat bars on the screen), and they say: "there're beat markers, they mark the beat." I think that, definitely, it will be different activities that you could do to work that in. Visually is excellent.

e and which musical concepts you think that can be taught with this?

t.c oh, I think it would be *rhythm,* definitely *rhythm* rather than *melody* ok? Because these are showing the *beats,* and what you're doing, and then there is a transfer of the *rhythm* and the *melody* that they are hearing to notation ok? Then, a step further is even to take the notation away and have them do the notation themselves, but I think that is definitely *rhythm*. It would be what they're hearing or finding the *rest,* you know, whatever is, yeah, that's what I will use this for.

e perfect. Do you think in any kind of learning activities that children can do while you are using this map?

t.c yeah, a continuation of something visual . What I would do before I get this listening map is… they will have a lot of experience at writing and reading those rhythms, and that is basically just quarter notes, eighth notes, and rest, ok, which is what they can read. And I would do little exercises before I would expect to extending to writing, you know, that kind of things. And from this little activity, it could be an extension, could be… they look at the rhythms perhaps and they decide, ok, we could work a little bit with *tone colour* (the quality or character of a sound played by an instrument) and then add non-pitch instruments and have them… (play the different instruments) as they are reading the rhythm, you know, the drums play this, and the sticks play this, or the metals play this, you know, like working on tone and colour. And also, they can relate that tone colour to the music that you think sounds better. You know these are just ideas of the top of my head, what you could do. It could be extended probably quite widely using that piece of music. You know, you could study instruments of course, you could study rhythm, good thing for beat… you could even do this with the grade 1 at the end of the year, you could probably.

Now, the writing part is not as good you know for the too young (from grade 1)

e so, they would just follow the map…

t.c yeah, and I always think that is a good thing to have a map to follow, because the children don't know what to listening for, you know. And you can say: "oh did you hear the French horn or something in the certain section?" well, they don't know where the section started or, you know, you really have to guide the listening. That's why in music I use the "Share the music" series, and there are excellent listening maps… to break down the piece into, and with this you can get into *form* as well. Ok, the different sections such as introduction, you know, and how many sections are, how could we label it, it is ABA or you know whatever, and then they can also do that by looking at the notation. Maybe, rhythmically, it's in certain form, you know. I think it can be extended, there are many possibilities and you can probably adjust it to what level of children you are at, you know, that kind of things. And the activities obviously would be on the computers, but after they have had the preparation, and we took this, and you could go on, and you could even transfer this notation that you have on the computers to a chart or whatever, and then do some of the classroom activities that you could do on the computers. I think that definitely *rhythm,* maybe, I don't think for *melody,* particularly, because it's not really showing where the melody goes or things like that, but I think definitely, that would be a good tool to listen to that, to Nutcracker.

e do you think that this could be an efficient tool for music instruction?

t.c oh definitely, because children are becoming, you know, quite proficient at keyboard skills. Like starting in grade 1 they have computer time, they're learning, so the actual physical thing won't be a problem for them. The machine is not a problem for them, they are not afraid of it, you know. And specially there is a mini program that goes with the series I have, but we haven't bought into it yet at our school, it's quite expensive, but we haven't bought into because a lot of is… like I said, is a timetable and to make sure that I will get the classes in there to use it. It will have to be a real conscious effort on my part too… like if everything was set up and was just handed to do, I would do it. But if

it is going to be a trouble, like it's hard scheduling and never being able to get in there and all that kind of stuffs, I probably won't do it. But I'm really pushing at my school to get this program for the children, because I went to the stuffs and it just has really neat things. It has something pretty much for every grade on it that goes with certain lessons in the book, you know. And so I think that anything visual like that, the kids just really by into, so I would certainly use something like that as part of the sessions for the rhythmic part. And like there are listening maps out, like I said, that show the different sections, that show pictures and instruments, or if there is a dance part, so the people dance, they are not moving, but they are dancing. So, this is on a transparency right? So yeah, definitely, the movement is something that the kids would like, I think. Anything similar to this is perfect. They like, the majority of kids out there are TV bugs or computer bugs, I mean. They don't want anything too dry, it has to be exiting for them, you know. I think, that's a good thing, yeah for sure. But I would definitely say that it would be to working with *rhythm.*

e and have you used anything similar to this animated listening map before or have you seen anything like that before?

t.c no, I've just seen one that, what is it called? It's called "dyno midi"? I think it is called, that goes with this "Share the music" series, and I opened up and looked at the things, and you would see… like it would be stuffs for grade 1, and it's not for every lesson. It's just for certain lessons, it would be something on the computers that they can use. So, I think that I definitely will use it if they would invest in it in my school to get ahead stuffs, so it would be workable in our lab, then I certainly would. You know, I got there stock sitting on my shelf ready to see if we can do it, so I think that definitely, and like I said, it wouldn't be… you have to prepare the kids for it, you know, for every lesson do things that force them to follow things after. And I think it's good that you don't use it for everything, you know what I mean? Because I think they don't expect to see everything in that kind of mode… you know… I think that I would like to use it, definitely. And I think this kind of idea I would assume is becoming more popular all the time. All the new materials out will have things like that… No, that's great! I think is good, it's a neat idea and I don't know how you design all these things, but I'm sure once you could do that, you could probably think in a

whole bunch of other things that you could do. How long did it take to design that?

e to design this? mmm, about two months, but first I had to do some data collection and analyze everything, and besides I didn't have the skills to do the animation, so I have to learn that also through the process.

t.c oh, I think that's wonderful, yeah I think it's…The children will love it, yeah for sure. Like I think would…depends on that, you know, like all the time, because then it isn't special anymore, you know. Because the kids work with computers at home and at the school, all that kind of things, but I think that to highlight every other lesson or a concept or something, you know. Let's see that you were doing some listening things, but you wouldn't use it all the time, you know. The next time they're listening something, you do something different and then come back to something similar to it in another time. No, it's a… I mean, I think the children can figure out right away what you're doing at, no problem. Yeah, because I'm sure if I ask the first time after they saw it, they will say: "oh, that's showing the beat." And I like the way you can see your beat is divided in your line and then you ask them: "what you see underneath?" and "what is that showing to you?" And "how many sounds you hear on that beat?" Yeah, yeah, visually, it tells them a lot of things, you know. So, you can really question them to see if they're piecing everything together, yeah, yeah. A lot of people will look at that not the way I did, but it does tell a lot of things. And I thing the kids can figure that out, no problem. Excellent!

e thank you, thank you for your feedback.

t.c but fun, it must be fun to do these things…

e yes, it is

t.c well, time, a lot of work too to design it, but very nice, yeah, yeah

e it's challenging too

t.c oh for sure, for sure, exactly. So will you be going to the schools and trying this with some of the children?

e I don't know yet. I will see if with the information that I am having from you, from the teachers, I am able to evaluate the project.

t.c so you want to find out what we will use it for? And whether we use it? What you think the children will react?

e and if this can be used with children?

t.c oh, that is perfect for really any level because the children, even the younger children, can read that notation, and yeah, I think it's a… And this would be very good when you get to things that are more complicated for like grade 5 or grade 6 could be for the older child. When you start working with more complicated rhythms too, you need to see that on the screen, and then I suppose that another separate, if you have a program where they can actually, you know… something where they could actually put in their own rhythms as opposed, that would be the next step.

e to make this interactive…

t.c hmm. (affirmation) You could leave something missing, and… something could be missed on there, and you have them fill on the blanks. I don't know how you can get that on the computers, but that would be something too, yeah. Or you could even take a continuation and put it actually on paper and have them fill it.

e oh yeah

t.c you know, you're listening to this and now "is this work right?" Or you could write it up and make mistakes on it and have them correct, you know. So, I think that there are a lot of possibilities, you know, thinking of the top of my head what I could do with it. I think it would be fun, I think that the kids will really enjoy it, they will enjoy it not realizing they're learning a lot, you know. I think that would be nice.

e that was one of my goals, I mean to do something that motivate them…

t.c exactly, exactly, yeah. At first would be just like, I'm sure that the first look at they will be watching the colours, watching the little dancer, and

then when showing it again, they will pick up more things each time as they look at. Hmm, hmm (affirmation). So, you can just design all bunch of things and send it to me, that would be fine (laughing)

e yeah, we can do that (laughing)

t.c no, that would be fun. I certainly think that's the way we have to go with teaching music. I mean, the children do so many things on the computer already; they do research, they're even doing like just keyboard skills, the little children are even, by grade 3 level, they're even typing up their stories. So, you know, they are certainly in tune with these kinds of thing, so there are no reasons why we can't be doing that, you know, in music. And it doesn't necessarily even has to be a listening piece, you can be doing something…

e like another activity…

t.c another activity as well, another concept, you know. It certainly is, I think that's where we go, where we should be right now.

e hmm, hmm

t.c good! That's great. Nice job.

e thank you

t.c yeah, I can't imagine how many hours you put into that but…

e yes a lot but…

t.c because it looks just so easy and just kind of simple for the kids to read and understand, but to get all that like now right? Good for you!

e thank you, thank you very much for your time and feedback.

Interview d
Music teacher *d:* t.d
Experimenter: e

Followed by a brief description of the instructional material, this is showed to the teacher. While seeing the animated listening map, the teacher makes the following comments:

t.d it keeps the beat

e yes

t.d cute, now, you change the screen because it's a repeated? or what does it mean?

e that is because the melody changes. The rhythm pattern is the same.

t.d so, the texture changes… so, when it changes the colours this means that the music quality, the timbre changes?

e so, the melody of the music changes, the melody pattern changes. The changes are demonstrating the form of the piece.

t.d ok, the form of the structure of the music. The form would be like you have…would you really have A?

e it would be A, B, A 1, and the coda

t.d hmm, for that first part…

e it demonstrates the structure of the complete piece.

t.d and you demonstrate that through the colours of the bands?

e yes

t.d ok, can we see that again?

e yeah, of course

t.d so, I just want to know if the kids could see the difference.

t.d hmm

While watching the animated listening map again, the teacher made the following comments:

t.d so, it repeats when he goes back…

e yes

t.d and then you change…

e hmm

t.d and repeat it again, so you have A-A, B-B, (waiting to listening the third form of the melody) so, this would be C?

e it's quite similar to A

t.d so, it would be A1?

e yes, A1 (while listening to the coda) and now, it's like the coda

t.d ok, so you can tell A-A, B-B, A1-A1, this is the same as A and then you end with the, we would say the ending, ok, so that's one little piece.

e yes, and I would like to show you another version of the same map

During the demonstration of the second version of the animated listening map, the interview continues as follows:

t.d so, they could (she follows the rhythm by tapping her lap) easy to follow

After seeing and listening to the animated listening map, the teacher expresses the following:

t.d ok, so they will now keep the *beat* on the beat, then you have the *rhythm,* and then you have the *form.* So, you are teaching all that at the same time plus the notation of the rhythm. Cute, really nice, yeah

e thank you, and do you think that this can be used in the classroom with children?

t.d ah, yeah, to listening, it is a short piece like this would be wonderful for grade 1, 2, 3 and you are taking just the theme of a…which theme is this in *The Nutcracker?* Which part of *The Nutcracker?* The *Chinese Dance?*

e yes, the *Chinese Dance*

t.d so, you are taking the *Chinese Dance* and because you break… we teach *The Nutcracker* in grade 2, so, if you could take them to the computer room and work with this…Would you have a developed… Would you want the teachers to develop a plan as to how to incorporate, but you would offer the technology, now do you have a series of these?

e a series? no

t.d or like I mean, this is your one project but would you have…

e this is like the pilot project, it's the main project. This is for my thesis so, I don't have to develop more than one

t.d oh, I see the idea

e so, this could be an example of an animated listening map, maybe another listening map with another musical piece could be used to teach other musical concepts

t.d yeah, yeah. Great, you know like I've, I haven't seen that much technology, usually, I don't even think I've, I have not seen a listening map with the music attached to the visual and then the notes. So, this is, yes, I definitely think it would be used. If you could put it on a CD ROM or the kids could go into the computer room or the computer in the classroom and put it on, and then develop a lesson around the listening. Sure, sure it could be used. I'm just thinking if there is any

way to change, so the change of colours of the form could be, when you have the light colour and it changes to maybe just to little bit darker, that's not a big change in the sound of the melody you're trying to say. But when it went to the red that was a bigger change…

e yes

t.d ok

e so, you think that between A and B should be more differences between the colours used?

t.d mmm, yeah, well it depends on how different is A from B; it's not that much different… Because it could be, well these are for phrases, so you actually go AA, no, you wouldn't go BB, I have to, I don't remember my form… AA because it's not much difference, because this is going to be the whole A section of the entire piece. Ok, AA BB AA could it end? No, it was what? From this colour (pointing at the colour of the borders on the screen) to a lighter colour?

e yes, to a lighter colour

t.d yeah, but that's what you mean, that's what you mean by that right? ok, let's try one more time. Jesus, it's a cute guy

e would you like to see this with the notation or the first one?

t.d this one

While listening to the animated listening map, the following comments are made:

t.d so, you have the orange now

e yes

t.d ok, so, it changes to… Oh what they did was tararara (the melody pattern is going up) to tiririra (the melody pattern is going down)

e so the melody is going down

t.d yeah

During the ending part of the musical piece played on the computer, the teacher expresses:

t.d this is great, makes it very easy to understand, yeah, sure

e and the musical concepts that you would teach with this would be…

t.d ah, *beat* and the *form,* and the *rhythm.* We use the eighth notes by the end of grade 1, the students have to learn ta-ti-ti and that's what this is plus the quarter rest, so that you have ti-ti-ta, you know, like for them to understand, that is how it works. Now another thing, sometimes we just add in grade 1, we do put the notes, but like if you were to do this kind of things (drawing the stems of the notes in a piece of paper) you know…

e yeah

t.d or you know what would be really cute for the grade 1's? If he is dancing instead of writing the music notation, a symbol

e oh, I see

t.d so, let's see what would be a symbol for this little dance? I don't know if you want to do… ah, like I know when we do let say "twinkle twinkle" so, we go "twinkle" (the teacher draws starts on a piece of paper) so, we have like two starts… "twinkle twinkle little little," and then you have a big start… "twinkle twinkle li-ttle star how-I won-der what-you are," you know, for rhythm. So, if you have a picture to start with, and then you can change to the sticks, to this (drawing in a paper the sticks or stems), and then, you can change to the real notation. This would be really cute but what could you use for the Chinese dancer, for the ti-ti?

e mmm

t.d that is just an idea for grade 1. So, for grade 1 you would do that. This would be grade 1 like at the beginning of the year, or actually

maybe you don't need this, but when we teach like primary songs, we start with the picture notation, and if you have "rain rain," you have a sort of like a little rain drops. Ok, if you have like rain drops or an umbrella like a little umbrella, anything like that, and then you manipulate them. So, if you want to teach the high and low for a simple song, you place the starts like "twinkle twinkle little star" (singing the melody of the song) so, you can place them in that way. But this is really good, I don't know if you want to bother with the symbols. But if you want to show a listening map with the melody, the song would have to be a lot simpler, because you are going tiririri ti ti ti. This is great the way it is, then you may use symbols just to show the contour of the melody, yeah

e yeah, yeah

t.d so, that is just an idea

e yeah, of course

t.d because here you're demonstrating what? Form and rhythm

e yeah

t.d and that's great. Maybe, in another thing, you can demonstrate a lot of contours, and you could do it, you know that's a very visual thing, and you could do whatever it would take… like you go up, you know, whatever the listening map is. Ok, but this is great, good.

e and can you think in some learning activities that children can do while you are using this listening map?

t.d ok, oh… let me see… Well, before they go to the map, there has to be a discussion or introduction of the piece, the story, to tell the story… And then say from this story, when the Chinese dancers come in and talk about the beautiful costumes, or yeah, so you have that discussion. As to the listening activities, you could have actual stepping, they could actually step that, like that little guy, they see it, they say: "now we can try it, we can try this little dance." So, they've seen him dance, they've seen how he will move, so you would have a dance activity (the teacher stands up to show the dancing activity herself) where you go ti ti ti ti,

and they know what it looks like in their heads, so they will actually dance it… So, that would be a movement activity, to dance like to the rhythm, or dance to the beat, like when he was dancing you have the beat, you can keep the beat with an instrument, and then ok, “I want you to take two steps for every beat” or for example you could say baby steps, you know, titi titi titi titi titi titi titi titi, and they can create their own dance after to the rhythm of this little piece. And it would be so cute to see them. So you can have dance and what else? Could you transfer this idea? so, they can make their own listening map. So, they’ve seen this listening map, you pick another simple song and maybe on a sheet of paper you would write the… (showing in an actual sheet of paper the activity), you symbolize like you did the beats. Now, how would they be able to do that? To draw their own listening maps of another piece maybe the *Arabian dance,* you know, if you are going to study *The Nutcracker* suite or the *Waltz of the flowers…*ta ta ta ta-a ta ta… So, they might (drawing individual flowers on the paper) you know, if you could transfer what they’ve learned from here, and then they can create their own with another piece. Because it’s very simple, like you’ll have to put on a sheet, a frame from them to work with, and they can draw the little flowers ah… and they might draw two little flowers… So, this would be one two three - one two three ta ta ta ta-a ta ta-a-a… So, I have to think about it but you can do movement, then they can do… draw their own, that is, create their own maps. Eventually, you will want them to be able to, maybe, create their own maps not on the computer because that would take… I don’t know how hard it is, I know, I can’t do this (laughing) but even just to draw it. So those are the two things that I would do with this. Yeah, so you start with, your activities would be first of all tell the story…

e hmm

t.d then discussion with the kids…

e hmm, hmm

t.d share… play the music, set up the characters you know…

e hmm, hmm

t.d maybe have them pat the beat as they listen, so that titi titi titi titi titi titi titi ta have the beat, that's easy to do, and then, then you will bring in: "well, now we are going to maybe look at what the music looks like." And you can bring them the listening map, and you will work with that. Now if you can put this on one of those computer screens, or you know, get the kids to go into the computer room. Would be nice if the school, see, you know, the schools don't have equipment to do like, some of them have equipment for Power Point presentations, so if you could put this on a big screen or they can go into the computer room and use it there, yeah

e yeah, yeah

t.d so, then you could do the listening map, and then you could do: create (writing on a sheet of paper the plan for the learning activities) "Now, you dance like the little guy", so create a dance…

e hmm, hmm

t.d to the rhythm… And then, they can create their own listening maps, their own map (writing in a sheet of paper). But, for the elementary, you know, they will have to do it on paper, and maybe in the Art area, in Art, they could take all these that they know and paint a picture, and then you could put them up on the room, or the listening maps, ok? Paint the picture of the Chinese part (writing on a paper) or the *Chinese Dance* in *The Nutcracker,* you know, they probably have little dancers dancing… What do you think?

e yeah, perfect, a lot of things!

t.d ok, so this will not happen just in like one (class), because we teach music for 20 to 30 minutes, so this would be like a whole unit on listening and appreciation

e hmm

t.d a whole unit on listening and appreciation, and the story would be *The Nutcracker,* yeah… I'll show what we have in our text books, ok I'll just go to get it, just to let you how they do the listening

After getting and bringing the text books to the table where the interview is set up, the interview continues as follows:

t.d so, when they are doing the listening at the grade 2, we can talk about many of these things. Ok, all the tempo, dynamics, the mood, and this is what they've done on, ok, what they compared was the *Trepak* and the *Arabian Dance.* So, they talked about the meter, the tempo, maybe timbre, other instruments, other elements, so there are activities… The Nutcracker play, other dance sections of the music, compare and identify tempo and meter in each, discuss the significance of the Nutcracker, ok, background information… (reading the activities from the text book). So, then in the book, it looks like this… Have you seen this book before?

e no, no

t.d ok, this is the book that we use for grade 2. (Looking for *The Nutcracker* section). Oh, here it is, "The Nutcracker listening, page 56" So, this is all they probably ever get, so you tell the story… So, basically *The Nutcracker* is for the meter or for the tempo, so we study the tempo that with the kids, and then they just… they basically just do the two, the *Trepak* and the *Arabian Dance,* so they compare these two dances for the fast and slow, yeah

e hmm, hmm

t.d I don't have the teacher book but anyway, so that's all they have, so if you have something like that, it would be really good and even in the listening program it's not animated, it would be so nice to have it animated, so I think it's a great idea. *Arabian Dance…* (reading from the text book the activities to do with the *Arabian Dance)* So, that's the kind of stuffs that they have… (showing the activities on the text book)

e so, you think that this can be combined with what you are already using in the class?

t.d oh yeah, oh yeah because, and it's great for them to look at that and then they say: "well we can try the dance." Because it's very simple steps you know. And if you did the *Arabian Dance,* I mean, no that you have to do that for your thesis. But if you were to do the *Arabian Dance,* then

your beat and your rhythm changes, and they could see the differences, and they can see the different moods. Like this is very light and happy and the *Arabian Dance* is very soft and flowing and more how would you describe it? Not exotic, but you could, you know, talk about the change in mood.

e hmm, hmm

t.d and the kids may be able to come up with their own if you compare the dances.

e hmm, hmm

t.d ok?

e yeah

t.d do you have any other questions?

e yeah, just one more question: have you used anything before that is similar to this listening map?

t.d well, not on computers, I don't know if you are familiar with "(name)"?

e no

t.d well, he was a disciple of Carl Orff, and he actually writes out listening maps, something like this, so that he has the beats, you know, for a whole piece of music, but it's all on papers, it's never been put on computer

e hmm, hmm

t.d yeah, ah I've not seen it and there is not computer program with this (signaling the text book) and this is a listening and appreciation. Ah, I'm just thinking trying to see in the other one… ah, no I haven't

e hmm

t.d you know, have you checked the Internet, because the Internet I'm sure they have lots of listening maps

e yes, hmm, hmm

t.d yeah, so yeah, ah possibly you know, if someone has some software out there that might have something like that. But I like the way this is done, it's very simple, it's not complicated

e hmm, hmm, that's great. So, it's clear to follow by the children?

t.d oh yeah, it's very easy to follow, yeah. All they will need would be a computer, a projector to project this onto the screen, yeah. Now the thing is the computer in a classroom situation, I guess, it would be loud enough, yeah, because it's pretty loud here. You have it at what volume?

e this is the highest volume, but we have little speakers

t.d yeah, yeah

e but, we can plug this to large speakers

t.d oh yeah, speakers, so that would have to be outline. Yeah, good! Anything else?

e no, mmm, so you think that this could be an efficient tool for music instruction?

t.d hmm, sure, it's beautiful. So, you only have to do this one thing for your thesis and then you will have to plan the activities and everything?

e no, it just because my thesis is in visual communication design, so that I have to visually communicate the music so the teachers can use this for the listening activities

t.d yeah, good

e so, for that, with only one listening map is enough to see if this can be used for music education

t.d yeah, sure. This works fine, ah, I'm just want to show you a picture of a listening map that we use, because this doesn't really have any picture, one more time (laughing)

e yeah, yeah

After getting and bringing other books to the table, the teacher makes the following comments:

t.d ok, so for doing the *Russian Dance*… So, put it on the overhead and then you have trata tatatata trata… whatever, and then you have the Trepak dancers, and then, this is how the music flows (showing the actual McGraw-Hill listening map) so the teacher follows, so you probably have already seen this. *Surprise Symphony*… ta ta ta ta ta… and then you have the activities here…

e and this is for beat here…

t.d yes, and then, that's the beat, and again you have different trains, this must be like the tempo on tempo, this is mostly for form, so that you have the trumpets and the horns, playing the "trembles" goes to the tuba, and then the beat section that goes from forte to piano. What is this one here behind? Oh, so this is the *Gigue* from the violin concerto, so they have the… yeah, so, this gives you an idea of what listening maps we do have, lot of pictures, and this is so cute because you have, oh here is *The Marriage of Figaro*… Ok, so that's gives you an idea as to all this

e yeah, yeah, thank you

t.d now, to put something like this on a computer with the music and the little guy pointing makes it that much easier for the kids

e yeah, because it's like demonstrated

t.d it's all demonstrated. Here, the teacher has to point. But this is the whole piece so if you get the *Russian dance*, it's all the Russian dance, so you have all the *Chinese Dance* there

e hmm, hmm

t.d yeah, and then you would just go on to like… if you have a longer piece where you have to have the form and then, you would just change the character and the beat or whatever, you see, like this, this is very simple… So, this is all we have that we use and this is the latest

e hmm, hmm

t.d so, that would be very welcome, so you can write down that I said: yes, it definitely would be useful for the teachers in animated listening maps, yeah, ok?

e ok, thank you very much for your feedback and time!

t.d you're welcome, it was fun. Ok, so good luck and…

e ok, thank you

t.d hope everything goes well!

e thank you, thank you very much!

Study conducted through observing a music class

Proposal for the study

The evaluation of the proposed animated listening map is part of the design thesis project. It comprises two small studies that are conducted to explore the effectiveness of using the material for music instruction. These studies are developed in partial fulfillment of the requirements of the Master of Design at the Department of Art and Design, University of Alberta. Specifically, the study conducted through observing a music class is aimed toward knowing the reactions and attitudes of children to the use of computer-based instructional materials in the classroom for teaching particular music curriculum's content.

The design thesis project consists of developing computer-based instructional aids to teach music literacy to children at the elementary school level. Particularly, the instructional material developed for the design thesis takes the form of an *animated listening map.* A conventional listening map is a type of instructional material that teachers use at grade 2 for introducing children to the understanding, recognition, and enjoyment of musical pieces by naturally associating familiar images with unfamiliar sounds. It is a spatial arrangement of images and iconic symbols that represents in a particular way the musical pattern described by a musical piece. An *animated listening map* is a spatial arrangement of images on the computer screen that change over time responding in a particular way to the musical pattern described by the musical piece being played on the computer.

With respect to the objectives of the study described above, a 30-minute music class with a group of 25 children will be conducted at the University of Alberta to obtain information through its observation. The information to be collected from this class concerns the following:

1) The effective use of the instructional material with children in the classroom
2) The effective use of the instructional material to teach specific musical concepts
3) The attitudes and reactions of children to the use of the instructional material in the classroom
4) The improvements of the instructional material to be done in order to further propose specific guidelines for the design of efficient tools for music instruction

Consent form for the observation of a music class
This consent form is provided to obtain your consent to my observation of a music class to be carried out by you at the Education Centre of the University of Alberta. My observation of the class is part of a study that is aimed to explore the effectiveness of using the computer-based instructional aid for music instruction. This material was created in fulfillment of the requirements of the Master of Design at the Department of Art and Design, University of Alberta, the study to be conducted is in partial fulfillment of these requirements.

A general description of this study, as well as a description of the conditions to be met during the music class, are specified below.

Design thesis project
The design thesis project consists of developing computer-based instructional aids to teach music literacy to children at the elementary school level. Particularly, the instructional material developed for the design thesis project takes the form of an animated listening map. An *animated listening map* is a spatial arrangement of images on the computer screen that change over time responding in a particular way to the musical pattern described by the musical piece being played on the computer.

Assessment of the material
The assessment of the material consists of the observation of a 30-minute class conducted with a group of 25 children from the Child Study Center of the University of Alberta. The assessment will take place in a classroom located at the south side of the Education Centre of the named University. In this room, the music class will be delivered to the children by using the instructional material being assessed.

Objective of the assessment
The general objective for conducting this study is to obtain information concerning the use of the material for music instruction. Specifically, this assessment is aimed toward determining the reactions and attitudes of children to the use of computer-based instructional materials in the classroom to teach particular music curriculum's content.

Participation in this assessment
If you agree to allow me to observe the music class, the following conditions will be met:

- any information obtained from this assessment will be used anonymously and will remain completely confidential with the aim of responding to the design thesis project.
- comments from the class will be collected by using a tape recorder with written notes as backup. The information obtained from this assessment will be made available to anyone interested in knowing about this study.

Are you willing to allow the observation of your class under the conditions stated above?

Yes ☐ No ☐

I agree to the terms:

Music teacher ____________ Date ____________

Thank you very much for your time. I would be very please to provide more information concerning this assessment. The written report will be made available to anyone who is interested in knowing about this study.

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Script for the music class

The following introduction, to the music class, was conducted by a professor from the Elementary Education department from the University of Alberta with a group of 25 children from the Child Study Center of the named University. The music class was part of the evaluation of the animated listening map that was carried out to explore the effectiveness of the material for supporting music instruction (see appendix B, p. 106).

Introduction to the music class

Professor:

Before demonstrating the animated listening map, the professor has a brief conversation with the children to share the experiences had since the last time he had seen them. Later, he introduces the experimenter to the class:

> Do you remember Mariana, who came to visit us before? She came to see our class one-day to see what we do. She is a graduate student in Art and Design, she does visual things and she does computer arts, and you are going to see something today, if you earn it. (Children laugh at his comment). And over there, that's my daughter Lora who is just so curious about what Mariana does that she wanted to come to see that too. Now, I need to make sure that you can see this board over here…

The professor makes himself sure that the children are able to suitably see the two boards where he wrote some rhythmic phrases before starting with the class. In the first board, he wrote an introduction of 8 beats without rhythm and three different rhythmic phrases with three different colours. In the second board, he wrote a longer rhythmic phrase.

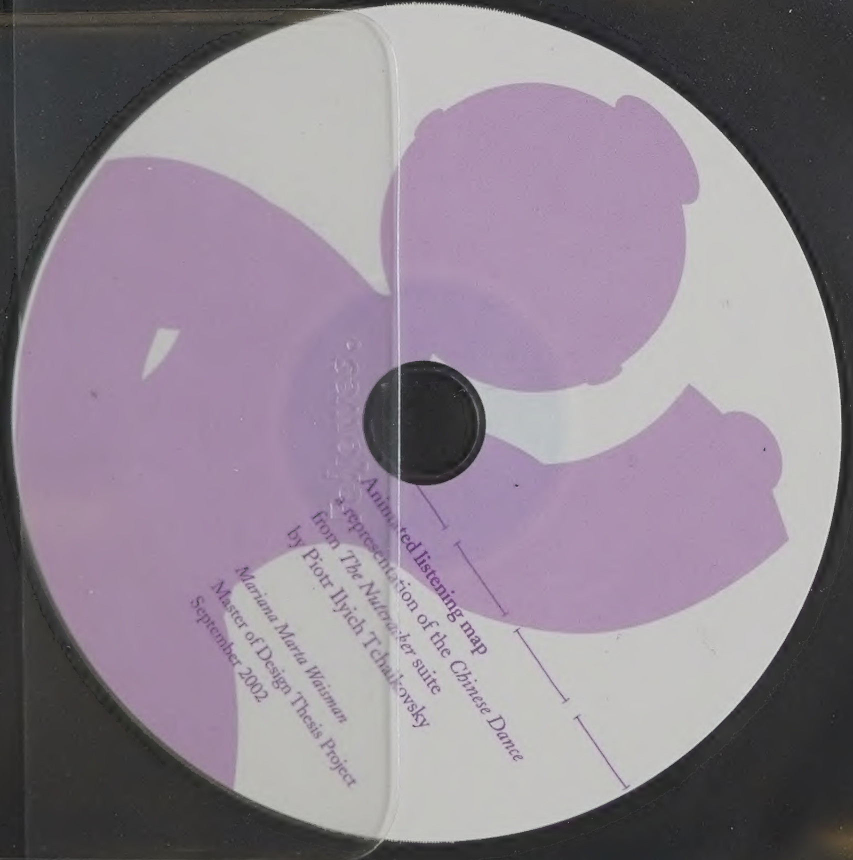
> Now, these rhythms, I think they are not too hard for you, this is going to be a little puzzle for you…

The professor shows to the children the rhythms written on the two boards and asks them to sing these rhythms out loud while he is marking the beat with a stick on the boards. One of the rhythmic phrases written on the first board corresponds to the rhythmic phrase of the musical piece represented by the animated listening map. In the music, this rhythmic phrase is repeated a number of times after an introduction of 8 beats without rhythm. As well, this rhythm is followed by a longer rhythmic phrase that comprises the ending part of the piece. The introduction of 8 beats without rhythm and the ending rhythmic phrase of the music are written in the first and second boards respectively.

> Now, you have read all of these rhythms that I showed to you absolutely perfectly, here is the puzzle: Mariana is going to show you an animation with a piece of music. I want you to figure out one of those rhythms,

only one of them we are going to hear a number of times and then, when we get to the last one… (the ending and longer rhythm written on the second board) I'll show you when we get here… You are going to hear one of those a number of times. I want you to be able to tell me, not until it finishes, which one you hear and see, you are going to see as well as hear, which one you hear and see a bunch of times. And if you can tell me how many times, I will be more than happy. Are you ready? And it's going to start with those 8 beats of rests and you are going to be able to see it. Ok, watch and listen…

(see pages 48-51 for ensuing activities)



Animated listening map

a representation of the *Chinese Dance*
from *The Nutcracker* suite
by Piotr Ilyich Tchaikovsky

Mariana Marta Waisman
Master of Design Thesis Project
September 2002

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